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Project ABLE : an application of military instructional systems development to secondary vocational education.

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PROJECT ABLE

AN APPLICATION OF MILITARY INSTRUCTIONAL SYSTEMS DEVELOPMENT TO SECONDARY VOCATIONAL EDUCATION

A Dissertation Presented

By

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B.S. State College at Boston, Massachusetts

M.Ed. State College at Bridgewater, Massachusetts

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Approved as to style and content by:

(Chairman of Committee)

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ABSTRACT

PROJECT ABLE

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EDUCATION

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The objective of this study is to compare military instructional system processes to those used in vocational education and to examine the processes for their appropriateness as educational alternatives. Comparison will be made of the instructional processes developed within the five year Project ABLE vocational curriculum effort and those of the United States Air Force Training Command from which the ABLE process evolved.

The method of attack will be to state the problems of occupational education which led to the ABLE project. Literature by noted professionals in the field of educational research will be examined and synthesized. A historical review of military and educational instructional systems processes will be conducted. The steps of the instructional systems method will be examined and documented in detail. Finally, the processes derived from the five

year ABLE effort will be assessed and conclusions and recommendations will be stated.

In summary, this case study will document five years of development and operation of ABLE concepts, conceived and operationalized by this author as a model for vocational education.

ACKNOWLEDGMENTS

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The School Committee of Quincy and Robert E. Pruitt were instrumental in giving me the opportunity to undertake Project ABLE, which is indicative of their concern for educational relevancy in performance as well as theory and to Dr. Lawrence P. Creedon who continued to have faith in me to complete the project, and to Maurice J. Daly with whom I have had the pleasure to work in the ABLE effort.

Finally a very special thanks is in order to my wife, Josephine, who gave much support when it was needed most, and to my children, Joseph, Dean Paul, Susan and John, who supplied a liberal measure of motivation.

J.S.N.

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CHAPTER I

INTRODUCTION

In this chapter, some of the problems of vocational education will be discussed. Then, the purpose of the study will be explained, objectives will be detailed, limitations will be given and the procedures and design of the study will be spelled out.

The Problems of Vocational Education

One fault of Massachusetts vocational practice is that often a student must have a declared vocational goal, and once entered in a program, will remain in that program until he graduates at grade twelve or drops out somewhere along the way. If he or the school, feels that he has made the wrong choice, he has two options: one to drop out, or two, begin all over again in another program. In addition, regardless of the wide ability differentials within the student population, all programs require the same length of time for students to complete or graduate from their program (three or four years). In addition, these occupational offerings are available only to declared vocational students representing approximately twenty percent of our total youth. ABLE attempted to change these procedures. It was known that in a student's early years a comprehensive plan or structure would be the best foundation for the decisions each student was to make. What ABLE did was to attempt to broaden each student's knowledge of the real world of work and to provide experiences which would assist the student to make a realistic appraisal of himself and the occupational goal he was moving towards.

The school cannot de-emphasize the necessity for careful consideration in selecting one's occupation. Grant Venn urged that the "transition from school to entry jobs for each student must become a part of the school's responsibility."[1] He further stated that "man will need to change his job four or five times during his work life."[2] If this is true, then a student who is properly educated about the world of work should recognize that the point of occupational entry is only the beginning point in his life's work. It appears that support for the philosophy of absolute career choices for vocational high school students is a mistake.

The final paragraph of the A.S.C.D. Yearbook stated:

> The person . . . who is well informed, and who is aware that he is in the process of becoming is the person able to survive and deal with the future.

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[1]Grant Venn, "The Changing World of Work and Its Implications for Vocational Education," A Paper Delivered at Summer Institute for Administrators of Pupil Personnel, Harvard Graduate School of Education, 1966, p. 3.

[2]Ibid.

> What is more, he will do a better job for the rest of us.[3]

It is common to point out that industry and technology are constantly changing in the world of work. However, there is little evidence of change in educational preparation for careers.

Industry keeps stating it needs workers with technological know-how which is readily adapted to the inevitable changes. Merely obtaining a job entry position is not enough today. At Harvard University in 1966, Grant Venn said: "preparation of individuals for specific job skills is simply not a defensible policy."[4] The National Committee on Secondary Education in Educating for Work added: "The prospect of change implies the danger of obsolescence of any set of skills."

Adam Curlell states: "any young person who enters a vocational program finds he is seriously restricting his educational future."[5]

The requirement that a student declare himself as a

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[3]Association for Supervision and Curriculum Development, Perceiving, Behaving, Becoming, Washington, D.C., a Department of the National Education Association, 1962, p. 253.

[4]Venn, op. cit., p. 5.

[5]Adam Curlell, "Some Educational Implications of Technology Development," A Report Presented by Committee of Harvard University Program on Technology and Society, 1965, p. 86.

vocational student for a vocation is a modern equivalent of the medieval indenture contract. In addition, another structural limitation is the standard time requirements for the programs. Because students possess different aptitudes and different abilities it would be logical to say, that a student should remain in the program only until he has attained the competence needed. However, our vocational programs are inflexible, and one person may not take a year and a half to complete the program while another takes three years. Further flexibility is possible and desirable. Today, if students are undecided about their vocations and have not selected a vocational program, they are locked in college bound or general education programs and are not allowed to enter the vocational programs. They too are bound by the academic equivalent of the medieval indenture.

Curlell states: "We are still saddled with a type of educational aristocracy in which only one type of education and one type of ability has precedence (academic)."[6] He further states three dangers:

> (1) We lose or fail to develop an incalcuable amount of talent. (2) Among these students who become frustrated or bored are often many who excel in technical capacity, drive and creativity. (3) The narrowness of our academic objectives reduces the vitally important capacity for flexibility.[7]

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[6] _Ibid._, p. 40.

[7] _Ibid._

If this is true, then vocational and academic offerings could have a vital role to play in the total education of many students if significant changes were to be made. It appears what is needed is a comprehensive occupational educational program and a curriculum appropriate for meeting student needs.

The Purpose of the Study

This case study on the derivation of the Project ABLE processes from United States Air Force instructional systems development documents how one group of school personnel attempted to provide a more meaningful program for secondary students. Instructional systems processes were utilized to develop comprehensive occupational offerings more closely aligned to the needs of students.

The instructional system development processes used are examined in detail, so that public school curriculum developers will have a blueprint to follow when building curriculum materials for their own systems. Included is an assessment of the components of ABLE which are most appropriate for immediate application in vocational and comprehensive secondary institutions.

Objectives of the Study

The general objective of this study is to provide documented information needed by teachers, administrators and decision makers who are involved or may become involved, in planning, developing and implementing an instructional system for vocational education.

Specific objectives are to:

Document information on the development and assessment of an instructional systems model for vocational education.

Describe in detail the creation and development of Project ABLE, the ABLE concepts and some of its unique features, strengths and limitations.

Assess the instructional systems products and processes developed by ABLE.

The main theme of this investigation is to document the development of ABLE processes to isolate components derived from the Air Force instructional systems development process of analysis, development, implementation, evaluation and revision and to show how those processes were utilized in the development of public school vocational education curriculum. Further, it will show the general applicability of this model to vocational education.

Limitations of the Study

This case study is designed to collect and present information and insight into the development and implementation of a vocational curriculum project utilizing processes derived from the United States Air Force. It is also intended to be an assessment of the processes derived.

Therefore, the study is confined within the range and domain of information, documents, reports and periodicals, from personal interviews and observations, from the files of the Quincy Public Schools, the Project ABLE Office, the American Institutes for Research and United States Air Force manuals.

The study is limited in respects by its dependence on the accurate and candid reconstruction of major events and activities as they occurred in the project.

Procedures

The descriptive case study method of research was used to collect the data and to document a description of the development and tryout of an innovative vocational curriculum. The following procedures have been utilized in the collection and preparation of the data for the study:

> As project coordinator, the author of this dissertation gained first hand information by participating in the design, development, implementation and assessment of the ABLE concept.
>
> The files of the Quincy School System, as well as the Project ABLE office, were made available for the purposes of the study and revealed much pertinent information.
>
> Local school and American Institutes for Research administrators, teachers, department heads, coordinators and students provided information for the development of the study.
>
> A series of interviews were conducted with administrators, faculty members, consultants and advisors to the ABLE project which provided insights from a local and national

perspective.

United States Air Force training manuals were analyzed and interviews were conducted with former Air Force Air Training Command personnel.

Design of the Study

This study presents a historical description of Project ABLE and its development from April 1965 through September 1970, and the derivation of Project ABLE processes from United States Air Force instructional systems development. The study makes an effort to document concepts, activities, planning, development and implementation of an instructional systems development model.

The study consists of seven chapters. In Chapter I, the introduction, the purpose, objectives, procedures and limitations of the study, have been set forth.

In Chapter II, Review of Literature, is cited the important related work of recognized educators. The review of literature also reveals helpful information in establishing the baseline of communications or definitions of curriculum. In addition, the review of literature related to instructional objectives points out the implications for evaluation and for training.

In Chapter III, Project ABLE and Military Instructional Systems Historical Review, the events detailing the evolvement of instructional system processes are described.

Also given are the definitions of terms needed to understand the technical language of the instructional systems movement.

In Chapter IV, Job Analysis and Task Analysis for the Derivation of Behavioral Objectives, ABLE Compared to the Military Model, are disclosed the Air Force and ABLE procedures for gathering job requirement data and for enumerating job tasks. Methods of developing behavioral objectives are also discussed. In addition, the characteristics of objectives are detailed.

In Chapter V, Instructional System Development and Validation, the development procedures for Air Force and ABLE criterion examinations are compared. Norm-referenced tests are briefly defined. Procedures for tryout of learning materials are discussed. Group sizes, selection and validation criteria are specified. Also covered are the descriptions of Air Force and ABLE learning environments. Student and instructor roles are spelled out and changes in classroom and laboratory methods are detailed.

In Chapter VI, the Assessment of ABLE Components, evaluation of ABLE components by a task force of the U. S. Office of Education, is documented. In addition, internal assessment procedures are discussed.

In Chapter VII, The Impact of ABLE, Conclusions and Recommendations, the effect of ABLE on the Quincy school system is discussed. The materials in use are shown. The guidance and vocational programs are outlined. Changes in grading practices are noted. Student tracking is illustrated and changes in the learning environment are detailed. In addition, the impact of ABLE on vocational education nationally is discussed. Finally, conclusions are drawn and recommendations are made based upon information documented in Chapters I through VI.

CHAPTER II

REVIEW OF LITERATURE

Curriculum Definitions

In order to establish a baseline of communication, a review of literature relating to a set of definitions by proponents of curriculum developed by instructional system methodology is necessary.

Robert M. Gagné (1969) reviewed recent developments, methods, approaches and definitions in curriculum. While he found merit in the descriptions offered by various contributors to the American Education Research Association monograph series on curriculum evaluation, he preferred the more specific definitions included in his 1965 book. He stated that:

> A curriculum is a sequence of content units arranged in such a way that the learning of each unit may be accomplished as a single act, provided the capabilities described by specified prior units (in the sequence) have already been mastered by the learner.[8]

Gagné further clarified his definition by stating that:

> A curriculum is specified when (1) the terminal objectives are stated; (2) the sequence of prerequisite capabilities is described; and (3) the initial capabilities assumed to be possessed by the student are identified.[9]

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[8] Robert M. Gagné, The Conditions of Learning, (New York: Holt, Rinehart and Winston, Inc., 1965).

[9] Ibid.

Relevant also, to the Project ABLE design as reflected in recent reports on curriculum development (Ullery, 1969),[10] is the emphasis Gagné has placed on well engineered and well managed development. Gagné states that:

> Curriculum design can be, and probably should be based firmly upon the kind of empirical evidence that can come from successive tryouts and systematic testing.[11]

The importance of this statement and the impact such an approach has had on systems type curriculum development and evaluation must be understood. It is the keystone not only to the developmental process but the evaluative process.

Hilda Taba defines curriculum development in a fairly broad way by including:

> (1) Diagnosing educational needs; (2) formulating objectives; (3) selection of content; (4) organization of content; (5) selection of learning experiences; (6) organization of learning experiences; and (7) determining the ways and means of evaluating effectiveness of what is taught.[12]

Taba seems to be in general agreement with Gagné.

F. Coit Butler referred to Gagné frequently in a

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[10] J. William Ullery, "Project ABLE Progress Report," Boston, Massachusetts American Vocational Association, 1969, p. 1-7.

[11] Robert M. Gagné, Curriculum Research and the Promotion of Learning, (Chicago, Rand McNally, 1967).

[12] Hilda Taba, Curriculum Development; Theory and Practice, (New York, Harcourt, Bruce and Ward, 1962), p. 35.

manual prepared for Job Corps instructional systems development. Butler defined training systems as:

> . . . a series of interrelated, interacting, precisely controlled learning experiences that are designed to achieve specific training objectives; but organized into a unified, dynamic whole which is responsive and adaptive to the individual trainee while fulfilling specific job-relevant training criteria.[13]

Butler went on to describe the process of curriculum development as a vigorous measurement of results in comparison to the specific performance objectives.

Instructional Development

Probably, the basic requirement for an educational objective is that it communicate unambiguously the intent of its author. Without such clarity, an objective has little chance to influence the educational process. Thus, only when an objective communicates without ambiguity can measures be developed to determine with confidence whether the objective has been met, or can learning experiences be devised to develop the desired capabilities in students, or can students use the objective as a guide to their efforts, or can sets of objectives be assessed for appropriateness and completeness. Lindvall notes that in many schools:

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[13] F. Coit Butler, Instructional Systems Development Manual, (Denver, Colorado, Rocky Mountain Education Laboratory, Inc., 1967), p. 25.

> . . . an outside observer may have difficulty in relating what he sees taking place in the day-by-day instruction in a classroom to the school's philosophy of education . . . (because objectives) are stated in such a general form that any teacher can look at them and, no matter what he does with his classes, can convince himself that these are the purposes that guide his teaching.[14]

To avoid this kind of confusion, objectives must use language and be so stated as to minimize the possibility of misinterpretation.

Learning involves changes in the capabilities of students. That is, a student has learned when he is able to demonstrate some capability which he could not demonstrate before the learning experience. Various teaching methods might be used in support of the students' learning activities, but teaching methods and aids are not the objectives of learning. Objectives should be statements about the student.

At least three relatively independent sources have recognized that communication is much improved when objectives are stated as observable performances of the student. Thus, educational testing and evaluation is an area from which emphasis on behavioral statements of objectives has been persistent. Tyler wrote:

> Each objective must be defined in terms which clarify the kind of behavior which the course should

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[14] E. F. Lindvall, Defining Educational Objectives, (Pittsburgh, University of Pittsburgh Press, 1964), p. 1.

> help to develop among the students; that is to say, a statement is needed which explains the meaning of the objective by describing the reactions we can expect of persons who have reached the objectives.[15]

A second source of emphasis is the work in military technical training where it was found essential to specify the performances expected of a student upon completion of training. Several accounts of the procedures for development of training objectives by "task description" are available.[16]

Finally, nearly all of the work on programmed instruction has proceeded by specifying instructional objectives first. A particularly readable guide to the preparation of objectives for instructional programs and some examples of the benefits of stating objectives in terms of the terminal behavior expected of the learner is provided by Mager.[17] He, as well as others, emphasize that the objectives must include specification of the important conditions under which the desired behavior is expected to occur and the criterion of acceptable performance.

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[15] R. W. Tyler, Constructing Achievement Tests, (Columbus, Ohio, Ohio State University, 1964), p. 18.

[16] J. D. Folley, Jean B. Fairman and Edith M. Joyce, "A Survey of the Literature on Prediction of Air Force Personnel Requirements," Wright-Patterson Air Force Base, Ohio, 1960, p. 60.

[17] Robert F. Mager, Preparing Objectives for Programming Instruction, (San Francisco: Fearon Press, 1962).

Since there is the need to assess students' learning progress, objectives are preferred which indicate the criteria for successful learning. The only way to verify that learning has occurred and to identify what was learned is to require the student to demonstrate his new capability in some kind of observable performance. Therefore, the objective must be of the type described in the preceding paragraph, namely, one which specifies the end performance desired of the student. It is important, of course, that the objective and the evaluation agree as to the criterion performance. Otherwise, the evaluation would not assess the student's learning of the stated objective. To avoid this difficulty, objectives must specify the important conditions under which the student must demonstrate his new capability and must clearly state the criteria by which his performance will be judged to show that the desired learning has, or has not, taken place. Objectives stated in this way directly imply the appropriate test or evaluation of learning.

Objectives also might be used as a basis for devising what Gagné has called effective tactics of instruction. If objectives could be written for which the effective conditions for learning were indicated directly, their value would be greatly enhanced.

In the effort further to improve communication and to aid in the planning of learning experiences, taxonomies of educational objectives have been prepared by Bloom, Englehart, Furst, Hill, and Krathwohl,[18] and Krathwohl, Bloom and Masla.[19] These taxonomies classify the intended behavior of students. The behaviors are considered to constitute a hierarchy. Consistent use of the categories of behavior as defined in these documents surely would succeed in improving the communication possibilities of many heretofore poorly defined words. However, Gagné points out that the categories of behavior defined by those taxonomies do not clearly correspond to a similar variety of learning conditions.[20] The kind of behavior defined in one category does not always require a set of learning conditions which is different from the set required by other behavior categories.

The selection of learning units, the sequence of units and the conditions under which each learning activity should take place are all arrived at by way of analysis proceeding from the objective stated in performance terms. The process, described by Gagné begins by identifying the

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[18] Benjamin S. Bloom, Englehart, Hill, Krathwohl, Furst, Taxonomy of Educational Objectives, (New York: David McKay Co., 1956).

[19] D. R. Krathwohl, Bloom and Masla, Taxonomy of Educational Objectives, (New York: David McKay Co., 1964).

[20] Robert M. Gagné, Defining Educational Objectives, (Pittsburgh: University of Pittsburgh Press, 1964), pp. 37-46.

capability required for performance of the task which is the objective. The question then is asked, "What kinds of previously learned capabilities need to be assumed if the person is going to learn this capability under a single set of learning conditions?"[21] The answer to this question identifies one or more new capabilities which are simpler and more general than the capability from which they were derived. The procedure for each subordinate capability is repeated until a hierarchy of capabilities is defined, the lowest level of which is not analyzable further or is within the repertoire of all students involved. The subordinate capabilities thus defined become the units of instruction.

Since a unit is a capability which is appropriately learned under one particular set of learning conditions, the categories of learning conditions identified by Gagné, as corresponding to particular capabilities are useful in differentiating learning units and in devising effective learning experiences.[22] Practical procedures to facilitate the analysis of objectives have been described (e.g., Miller) as "task analysis."[23] However, there is no

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[21] Robert M. Gagné, Human Functions in Systems, (New York: Holt, Rinehart and Winston, 1962), pp. 35-73.

[22] Robert M. Gagné, Learning and the Educational Process, (Chicago: Rand McNally Co., 1965), pp. 1-14.

[23] R. B. Miller, Task Description and Analysis, (New York: Holt, Rinehart and Winston, 1962), pp. 21-62.

taxonomy of performance (tasks) which can be used in stating "course" objectives so as to have direct differential implications for appropriate learning conditions.

Tyler has observed that clarity sometimes is confused with a high degree of specificity when selecting the capabilities to be represented in course objectives. He emphasizes that empirical evidence, gathered from experience in using an objective, is essential to final evaluation of the appropriateness of its level of generality. He suggests, however, that the appropriate level of generality is the level of behavior which is required for effective use in life. That is, the performance required by a course objective should be a behavior which can be valued in and of itself.[24] This consideration results in objectives similar to the "tasks" defined in military training research as, "a group of activities that generally occur close together and have a common purpose."[25] An example of a performance suiting Tyler's criterion and Smith's definition would be: repair a carburetor; another would be: translate into English a paragraph from a French newspaper.

This review suggests that the educational objectives

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[24] R. W. Tyler, Constructing Achievement Tests, (Columbus, Ohio: Ohio State University, 1964), p. 35.

[25] R. G. Smith, Jr., The Development of Training Objectives, (Alexandria, Virginia: George Washington University, 1964).

we should seek are unambiguous statements of student performance which include the criteria of success and the important conditions under which the performance is to take place.

Curriculum Evaluation

Stanley J. Ahmann in his discussion of curriculum evaluation states that:

> As a first step, we certainly need a clear concept of that which is to be evaluated; more specifically, the curriculum. Secondly, we need clarification, at least in a general way, of the methodological approaches available to us as we face various evaluation problems.[26]

Ahmann then cited the importance of Gagné's works in the specification of curriculum and objectives. H. J. Sullivan, in his review of curriculum evaluation research, appears to be in agreement with Gagné and Ahmann. He states: "Assessment based upon instructional objectives is a crucial part of well-designed formative evaluation."[27] Sullivan also placed emphasis on instructional objectives formulated as behavioral statements.

Robert E. Stake points out that measurement consultants usually recommend specification of objectives in

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[26] Stanley J. Ahmann, Perspective of Curriculum Evaluation, (Chicago: Rand, McNally, Inc., 1967).

[27] H. J. Sullivan, Objectives, Evaluations and Improved Learner Achievement, (Chicago: Rand, McNally, Inc., 1969).

behavioral terms.[28] On the other hand, Myron J. Atkin states that the behaviorist approach can misguide evaluation efforts and disembody an educator's purpose.[29] However, such theorists, through their criticisms, are most likely not thinking in terms of vocational education but of the academic arena. There is little doubt that the theorists from the academic community are strongly influenced by, and speaking directly to, the college preparatory curricula. The pragmatic focus of vocational and technical education might well elicit a different response from many of the critics of the behavioral sciences (or at least the way behaviorists would formulate educational objectives and organize curricula).

Since there is broad agreement that objectives must be stated in order to define curricula and evaluate programs, two major classification frameworks should be briefly reviewed. Robert F. Mager, Gagné and others place emphasis on observable and measurable behavior. Furthermore, Gagné, in his book "Conditions of Learning," provides a classification system for the kinds of learning (or

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[28] R. E. Stake, Toward a Technology for the Evaluation of Education Evaluations, (Chicago: Rand, McNally, Inc., 1967).

[29] Myron J. Atkin, "Some Evaluation Problems in a Course Contents Improvement Project," Journal of Research in Science Teaching, 1963.

prerequisite levels of capability).[30]

Benjamin S. Bloom and D. R. Krathwohl, classified objectives in terms of the cognitive domain (knowledge and intellectual skills relevant to use of knowledge), the affective domain (attitudes and values), and within each of these domains developed a taxonomy or hierarchy of levels.[31] Other publications have been provided in the psychomotor domain (manipulative and motor skills). H. Grobman, in analyzing the various classification methods, has stated that, "While these approaches are not deliberately juxtaposed by their authors, use of one may preclude extensive use of the other."[32]

Sullivan was more critical in his analysis of the taxonomy (provided by Bloom, Krathwohl and others) and stated that:

> Any attempt to use the taxonomy in the formulation of objectives must take into account its lack of precision in indicating either specific overt behaviors to be performed by the learner or the conditions under which they will be performed.[33]

Sullivan further elaborated by stating:

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[30] Gagné, loc. cit.

[31] Krathwohl, Bloom, loc. cit.

[32] H. Grobman, Evaluation Activities of Curriculum Projects, (Chicago: Rand, McNally, Inc., 1968).

[33] H. J. Sullivan, Objectives, Evaluations and Improved Learner Achievement, (Chicago: Rand, McNally, Inc., 1969).

> Thus, Krathwohl's statement that curriculum analysis using the taxonomy "aids in placing the material in the program sequence and in planning the overall development of the skill or ability" simply is not correct. The taxonomy's lack of specificity in dealing with task analysis and task description renders it useless for the purpose of sequencing instruction. At best, the taxonomy serves as a guide for describing very general desired outcomes of educational programs and for suggesting objectives which then must be stated in terms of observable learner behavior to be useful for evaluation and instructional purposes. Perhaps the most serious problems with the taxonomy are related to the lack of evidence that there is any generalizability of the imputed mental processes across subject matter content.[34]

Lester J. Briggs in examining factors related to the sequencing of instruction referred also to the cognitive theories:

> If it is correct to recommend that behavioral objectives should be stated for all courses, the apparent implication is that the kind of theory and procedure employed by Gagné in regard to the nature and sequencing of instruction would then appear more precise and useful than the cognitive theory underlying the utilization of advance organizers.[35]

An important aspect of ABLE development was the relationship of the job hierarchy to the specific kinds of learning as defined by Gagné, required at each particular level within the job family hierarchy. Gagné identified eight major classes of capabilities which he linked to

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[34] Ibid.

[35] Lester J. Briggs, Sequencing of Instruction in Relation to Hierarchies of Competence, (Palo Also, California: American Institutes for Research, 1967).

corresponding kinds of learning, each of which begins with a different state of the organism and ends with a different capability for performance.[36] The prerequisite for a type of learning is what distinguishes one type of learning from another. The internal conditions for chaining, for example, require that the individual has previously learned stimulus response connections available to him, so that they can be chained. The generalizations applied to the varieties of learning may be briefly stated as follows (types indicate kinds of learning): Problem solving (type 8), required as prerequisites; Principles (type 7), required as prerequisites; Concepts (type 6), required as prerequisites; Multiple discriminations (type 5), required as prerequisites; Verbal associations (type 4), or other chains (type 3), required as prerequisites; Stimulus - response connections (type 2).

Action verbs describe the major tasks of lower level jobs such as identify, indicate, hold, locate, pick-up, repeat, etc., also correlate with the action verbs related to specific kinds of learning indicative of type 1 and type 2 learning as described by Gagné. On the other hand, action verbs which describe the major behaviors of high level jobs (analyze, contrive, develop, diagnose, troubleshoot,

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[36]Gagné, loc. cit.

etc.) are more likely to correlate with the action verbs related to the type 7 or 8 kinds of learning. If the type 2 learning is prerequisite to type 3 and 3 to 4, etc., then most of the skills and knowledges basic to the lower level jobs are prerequisite to effective and functional performance at the higher and more sophisticated job levels.

The application of behavioral objectives and the categorization of job clusters on a hierarchy of skills and knowledges in the manner recommended in this document is congruent with the theory and procedures advocated by Gagné. However, this is not to imply that formative evaluation activities would be restricted to the behavioral objectives and criterion assessment measures. As Grobman points out:

> . . . even the projects most concerned with behavioral statements do not ignore formative evidence simply because it is not germaine to their lists of behavioral objectives.[37]

This plan will also deal with the broader problems of instructional system development and evaluation. The focus will center, though, on a program of successive tryouts and systematic testing. And as Gagné writes, "One can select textbooks, motion pictures, laboratory equipment, even teachers, but one does not select content. It is derived from objectives."[38]

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[37]Grobman, loc. cit.

[38]Gagné, loc. cit.

Stanley J. Ahmann, in his synopsis of the various aspects of curriculum evaluation, found little comfort in the general progress shown to date. He concluded that "from any angle that it is to be viewed, the problem of curriculum evaluation is enormous. Indeed, perhaps in the minds of some it is better described as horrendous."[39]

John Easley, Jr., in his review of research for the seminar at the University of Illinois, stated that:

> Efforts made in the direction of summative evaluation, teacher variables, psychological studies of a teaching method, and follow-up studies have raised serious problems of research methodology which await further investigation before generally useful results can hope to be obtained.[40]

Robert E. Stake, in a paper also presented at the University of Illinois seminar, made reference to the disagreements evident among the accepted leaders in the field of curriculum evaluation. For example:

> As to which kind of evaluation -- absolute or relative -- to encourage, Scriven and Cronbach have disagreed. Cronbach suggests that generalizations to the local school from curriculum-comparing studies are sufficiently hazardous (even when massive, well-designed, and properly controlled) to make them poor research investments. Moreover, the difference in purpose of the two programs is likely to be sufficiently great enough to render uninterpretable any outcome other than across-the-board superiority of one of them. Expecting that rarely,

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[39] Ahmann, loc. cit.

[40] John Easley, Jr., "Evaluation Problems of the UICSM Curriculum Project," University of Illinois, 1966.

> Cronbach urges fewer comparisons, more intensive process studies, and more curriculum "case studies" with extensive measurement and thorough description. Scriven, on the other hand, indicates that what the educator wants to know is whether or not one program is better than another, and that the best way to answer his question is directly.[41]

Scriven, however, in his more recent AERA monograph paper on curriculum evaluation, seems to find a broader area of agreement with Cronbach.

> Thus, it may even be true that "the greatest service evaluation can perform is to identify aspects of the course where revision is desirable though it is not clear how one would establish this, but it is certainly also true that there are other extremely important evaluation services which must be done for almost any given curriculum project or other educational innovation.[42]

Scriven also concluded in a similar reference to formative evaluation:

> One role that has often and sensibly been assigned to evaluation is as an important part of the process of curriculum development (another is teacher self-improvement). Obviously such a role does not preclude evaluation of the final product of this process. Evaluation can and usually should play several roles.[43]

Note that in each case, Scriven qualified his recognition of the important role of process evaluation with reference

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[41] Robert E. Stake, "The Countenance of Education Evaluation," University of Illinois, 1966.

[42] Michael Scriven, The Methodology of Evaluation, (Chicago: Rand, McNally, Inc., 1967).

[43] Ibid.

to the "other important evaluation services."

However, even in those cases where summative type techniques are proposed, every effort should be made to apply the information to program improvement. Scriven has stated that Cronbach is not clear as to how one would identify, through evaluation, aspects of a course where revision is desirable.

Instructional systems development, especially that in which "products" such as programmed instruction packages are not the outcome, should rightly heavily emphasize the formative types of curriculum evaluation. Grobman states that the two best adjectives to describe curriculum project evaluation are "emergent and dynamic" (for the service functions to be performed).[44] The regenerative component of Project ABLE's management and evaluation plan for instructional system development with the iterative feedback loops was applicable not only to the initial development but to the on-going operational system. This then, fitted the Grobman definition and was, primarily, formative kinds of evaluation.

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[44] Grobman, loc. cit.

CHAPTER III

PROJECT ABLE AND MILITARY INSTRUCTIONAL SYSTEMS HISTORICAL REVIEW

The Author's Role in Project ABLE

On June 8, 1967, the writer was appointed as Quincy's Project Director of Project ABLE, a five-year effort to create, develop and implement curriculum for the non-college bound.

Project ABLE was funded by the U.S. Office of Education and developed in cooperation with the American Institutes for Research, Pittsburgh, Pennsylvania. As Project Director, the writer was to be responsible for the development of a relevant, individualized, instructional program integrating vocational education programs with the academic.

In connection with his responsibilities, the writer attended many state, regional and national seminars and in-service training institutes in order to build personal skills in behavioral approaches to curriculum development.

Because of his ABLE experience, the writer was able to obtain an in-depth understanding of curriculum development, of the processes leading up to the development of an instructional program based on a behavioral analysis and stated in terms of specific performance objectives.

As Project Director, the writer was responsible for integrating Project ABLE students and learning materials at the Quincy High School and Quincy Vocational-Technical

School and was instrumental in the development and purchase of relevant learning materials as well as the structuring of in-service training programs for teachers working in Project ABLE.

As Quincy's Director, the writer was able to provide assistance in public school operation and procedures to the American Institutes for Research resource team of behavioral psychologists, consultants and writers.

During his service in Project ABLE, the author supervised a staff of some 30 teachers, coordinators, learning psychologists, technical writers, illustrators and clerk-secretaries.

Events Leading to the Establishment of the ABLE Project

As early as 1963, administration in the school system of Quincy, Massachusetts, took a positive step toward changing the output of its secondary schools. Dr. Paul Gossard, Superintendent of Schools in Quincy, contacted Walter J. Markham, Director of the Vocational Division of the State Department of Education to arrange a meeting at Quincy on January 15, 1963, to discuss the various programs related to the vocational education of the youth of Quincy.

Foremost in the discussion was Dr. Gossard's plan for vocational training for the youth who will not pursue college, vocational or commercial courses, yet need an occupational skill to be assured of a successful economic future.

In April of 1963, the Division of Vocational Education of the Massachusetts Department of Education issued a report which recommended to the Quincy School Committee and Quincy administrators that a new vocational-technical school be established.

Guidelines were established for the new school, including the development of curriculum.

Original concepts were further defined to establish a basic division of the curriculum around families of related jobs. There was a particular concern with the education of the culturally disadvantaged who may manifest limited capabilities for learning. A particularly challenging part of the total problem related to the overcoming of initial cultural and educational disadvantages which in their cumulative effects showed themselves in lowered student motivation and achievement.[45]

Preparation of a program of study for the new school was a joint research project of the Quincy Public Schools and the American Institutes for Research, Pittsburgh, Pennsylvania. It was sponsored by the U. S. Office of

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[45] Edward Morrison, "Project ABLE," Address presented in Quincy, Massachusetts, to the Kiwanis Club on September 13, 1965, and to the Rotary Club on September 14, 1965.

Education and was scheduled over a five-year period from its beginning in April 1965. The total budget for five years approached $975,000.00, of which approximately one-third represented locally contributed monies. However, actual funding occurred on an annual basis in terms of the extent of effort programmed for the particular Fiscal Year. The staff included three full-time research people from the American Institutes for Research and eleven faculty members from the Quincy Public Schools, who combined half-time on the project and half-time in teaching. In addition, teachers throughout the system provided special assistance from time to time. A panel of seven advisors, each of whom was a nationally eminent scholar or educator, met several times each year to provide technical review and guidance to the effort, and a local advisory committee composed of Quincy businessmen and civic leaders met monthly to consider requirements of the physical plant and plan for graduate placements.[46]

The official title of the new program was "Development and Evaluation of an Experimental Curriculum for the New Quincy (Massachusetts) Vocational-Technical School." However, the code name "Project ABLE" was being used as descriptive of the basic purpose of the study. That purpose was to provide every student not in the college

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[46] Ibid.

preparatory program with an opportunity to achieve competence in each of three areas:

1. Skills and knowledges in a chosen field of work;

2. the individual's role as a citizen;

3. independent pursuit of self-fulfillment and new learning.[47]

The curriculum for the new school was intended to extend from the 9th to the 14th grade, to include post-12th grade instruction in areas like electronics, computer data processing, and the machine tools technology. The specific job families around which both the new school building and the curriculum were organized are the following:

1. Business Education - Secretarial, Clerical, Bookkeeping, Sales;

2. Computer Data Processing - Equipment Operators, Programmers;

3. Electro-Electronics - Electrical Installation, Electronics Repair;

4. Foods Preparation - Food Service, Food Processing;

5. General Piping - Plumbing, Pipefitting, Refrigeration;

6. General Woodworking - Carpentry, Patternmaking, Boatbuilding;

7. Graphic Arts - Printing, Commercial Art, Drafting;

8. Health Occupations - Medical Assistants, Personal Care;

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[47] Ibid.

9. Home Economics - Homemaking, Home Services;

10. Metals and Machines - Sheet Metal, Machinists, Foundry;

11. Power Mechanics - Auto Body, Auto Mechanic.

The principal goal of the project was to demonstrate increased effectiveness of instruction whose content is based upon explicit derivation from analysis of desired behavior after graduation. Rather than taking a total body of knowledge and drawing content from it, curriculum was to be defined by what technology and industry needed for job success. The goals of the proposed project itself were conceived as part of a larger framework for education at the secondary level, pertaining particularly to those students who would not obtain a college bachelor's degree, and who comprised a large proportion (75-80%) of the school population. Such education was not conceived as being narrowly vocational, but rather was designed to produce effective and well-adjusted citizens for the modern world. Accordingly, the design of curricula and instructional procedures was intended to place suitable emphasis upon the need for generalizable knowledge having the aims of responsible citizenship and self-fulfillment as an individual, as well as flexibility of vocational choice in the face of changing occupational patterns.[48]

The individual student approaches the choice of education at the secondary level influenced by factors in the community and his family, and by guidance obtained within the school system. An initial appraisal is made of his skills and knowledge for the purpose of guiding his tentative choice of a course of study. The school needs to be concerned not only with the individual's vocational goals but also those pertaining to his functioning as a citizen and as an individual concerned with fulfillment as a person. The instructional program of the school is devoted to establishing in the individual the skills, knowledges and values that he needs to become an effective individual in society. It makes provision for those whose vocational education turns into a professional one at the college level, those who will achieve the competence of technicians, and those who will become skilled operatives in industrial or service occupations. In addition, it makes provision for the achievement of educational objectives for the individual student, irrespective of

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[48] Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, A Proposal Submitted to the U. S. Commissioner of Education, Under the Provisions of Section 4(c) of the Vocational Education Act of 1963, by Quincy Public Schools and American Institutes for Research, Pittsburgh, Pennsylvanis, 1964.

cultural or educational limitations which may affect his level of intellectual functioning. Ultimately, the process is expected to prepare the individual as an effective adult, leading a satisfying and successful life in all three areas of vocation, responsible citizenship and individual self-fulfillment.[49]

Organizational Planning. Organizational planning was concerned with:[50]

1. Achieving an appropriate balance of conceptual to manual skills in technician training.

2. Providing adequate opportunity for students to learn related and relatable skills and subject matter without sacrificing vocational learning.

3. Individualized scheduling.

4. Providing a differentiated curriculum on a continuum from practical to theoretical.

5. Programming with sufficient flexibility to permit vertical and horizontal transfers.

6. Making cooperative arrangements with business and industry that would provide valuable learning experiences which could not be provided in the school.

Three factors conspired to make the Quincy Vocational-Technical School of great potential importance to vocational-technical education research:[51]

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[49] Ibid., p. 1.

[50] Ibid.

[51] Ibid., p. 2.

1. The full brunt of modern technological change was upon American business and industry, but no parallel dynamic had yet burst upon public vocational education.

2. Major attention was currently upon vocational and technical education from a variety of disciplines and major institutions in our society. The breath of change was in the wind. The opportunity for innovation and breakthrough had never been better.

3. Educational technology had developed rapidly in the last few years and represented a real potential resource if it could be appropriately tapped for the peculiar needs of vocational and technical education.

It is within this context that Quincy school administration had taken an experimental approach to vocational-technical education with the approval of state and local levels. It is within this context that the building of a new school took place to provide a unique opportunity for innovation. The curriculum for the new school was intended to extend from the 9th to the 14th grades, to include post-12th grade instruction in such vocational areas as electronics, metals and computers.

The program and architecture of the new vocational-technical school in Quincy were built around the concepts of job families. The school building was designed by Caudill, Rowlett and Scott, an outstanding firm of school architects who have demonstrated leadership in the development of schools with flexibility of function. Outstanding features of the design of the building are provisions for flexible placement of internal walls and for adequate above-ceiling spacing of utilities cabling. In general, it may be said that the possibilities of innovation and experimentation had been carefully incorporated into building design. It was proposed that support be provided for the next logical step - development and evaluation of a new curriculum based on an explicit derivation from the criterion performances desired of graduates.[52]

Definition of Terms (ABLE). For those readers unfamiliar with instructional systems terminology, an appendix of technical terms has been provided. (See Appendix A.)

The Proposal

The ABLE proposal was a joint effort on the part of the American Institutes for Research and the Quincy Public Schools. The proposal was submitted to the U. S. Commissioner of Education, Department of Health, Education and Welfare, Washington, D. C., on November 6, 1964. (See Appendix B.)

On March 29, 1965, the Office of Education, Department of Health, Education and Welfare, Washington, D. C., released a letter-contract to Dr. John C. Flanagan, President of American Institutes for Research, Pittsburgh,

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[52] Ibid.

Pennsylvania, for "Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School," under PL 88-210 - (Vocational Act of 1963). (See Appendix C.) It was to be under the direction of Dr. James W. Altman with Mr. Michael Russo as the project officer and John P. L. Thorslev as the Contracts and Grants Officer.

On May 8, 1965, a conference was held at the Sheraton Motor Inn, Quincy, Massachusetts, to enable personnel from American Institutes for Research to meet with Quincy Public School people to explore the cooperative project. (See Appendix D.)

The first meeting of the Advisory Panel for Project ABLE was held on June 26, 1965, at the American Institutes for Research, 410 Amberson Avenue, Pittsburgh, Pennsylvania. (See Appendix E.)

On September 16, 1965, Robert Pruitt, Quincy Superintendent of Schools alerted Quincy Secondary teachers to the importance of the ABLE project.

Project Goals. The principal goal of the project was to demonstrate increased effectiveness of instruction whose content is based upon explicit derivation from analysis of desired behavior after graduation. The subordinate goals which were embodied in the plan are as follows:[53]

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[53] *Ibid.*, p. 9.

1. <u>Development of educational objectives.</u> The intent here is to identify the behaviors which are desired of the student when he has completed a particular course of instruction. These objectives will be stated in specific, operational terms. While emphasizing the vocational area of educational goals, they will include the development of individual attitudes toward work, habits of work, and standards of excellence. They will also give due consideration to the goals of self-fulfillment and good citizenship.

2. <u>Derivation of curriculum requirements.</u> Curriculum needs will be derived by an explicit and rigorous method, described in terms of topics within each "subject," and placed in an instructional sequence which takes prerequisite knowledge systematically into account. Particular attention will be paid to the overcoming of individual deficiencies which may represent the cumulative effects of cultural or educational deprivation.

3. <u>Description of needs for prerequisite learning in junior high years.</u> The elaboration of a new curriculum for the vocational-technical school will also make possible the specification of prerequisite knowledges to be acquired in junior high years of schooling, including the kinds of student preparation which might be gained in industrial arts and other basic areas of instruction. The aim of this description of preparatory instruction will be to make possible the development of broad exploratory programs in the junior high grades by the Quincy schools, to prepare students for productive educational and vocational careers.

4. <u>Effecting changes in student viewpoints toward the new school.</u> The new school, with its newly designed educational offerings, should become attractive to students of a variety of backgrounds and abilities. To insure that 9th grade students will make suitable choices, a special information and guidance program directed to this

end will be undertaken. This involves the in-service education of junior high school guidance counselors, and the provision of materials and information for junior high students.

5. Individualizing instruction. A set of procedures will be devised which encourage the student to take responsibility for his own learning, and to pursue specific instructional objectives which he understands and accepts. This outcome in turn leads to the tailoring of instruction, within limits, to meet individual student needs.

6. Student evaluation. Appropriately derived topic objectives will lead directly to measures of student performance. It is desired here that all "units" of instruction have performance measures which are available to the student, to instructors, and to guidance counselors. The student evaluation file should be a clear history of learning achievement.

7. Program evaluation. Student evaluations will yield many of the basic data for program evaluation. A comprehensive program of evaluation will include other objective measures of immediate outcomes, as well as the foundations of techniques for the later collection of follow-up data on educational outcomes after graduation.

Specific Outcomes. The findings and outcomes of the proposed program were expected to provide a demonstration of national significance regarding the improvement of the status and conduct of vocational education. More specifically, the expected outcomes may be outlined as follows:[54]

1. The demonstration of applicability of newly

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[54] Ibid., p. 11.

developed educational technology to an important enterprise in vocational education. Included in this technology are methods of defining educational objectives, deriving course content, individualizing instruction, measuring student achievement, and evaluating program results.

2. Demonstration of the feasibility of highly flexible planning of vocational education for the individual student, incorporating goals of vocational competence, including positive attitudes toward work, effective work habits, and standards of performance. In addition, the goals of responsible citizenship and individual self-fulfillment will be incorporated and illustrated by a model providing a concrete description of such a system.

3. Increased amounts of student motivation and achievement, related in unusual ways to background and ability factors.

4. Development and application of technique of providing instruction which takes full account of individual differences in ability, interest and prior learning.

5. Development and application of new materials for student guidance in the junior high years, in preparing students to take advantage of the opportunities offered by sound vocational education compatible with their interests and abilities.

6. Demonstration of high amounts of vocational competence and versatility on the part of graduates of vocational and technical courses.

7. Design and establishment of a continuing system for evaluation of vocational education in the Quincy Public Schools in terms of procedures for assessing outcomes following graduation.

8. A set of reports and associated instructional

> materials which will account for the study and its findings, intended for the wide-spread dissemination of practical techniques, results and conclusions.

Administration, Staff and Participants

It was proposed that the American Institutes for Research become the executive agent for the program, receiving and disbursing the funds required for its accomplishment. Four main elements in the organization of the program were planned: (1) a staff of research investigators experienced in educational research in the areas of vocational and technical education, provided by A.I.R.; (2) experienced educators of the Quincy Public Schools, some of whom would devote full-time as members of the research team to plan and select instructional materials and methods, while others would serve as consultants in vocational education in particular fields; (3) a panel of university scholars who would meet periodically to review statements of educational objectives, and to give general guidance in the means of achieving project goals; and (4) supervisors of the Massachusetts Division of Vocational Education, and also personnel of the Division of Vocational and Technical Education, U. S. Office of Education, who would function as advisors in the planning of vocational education in various fields.

American Institutes for Research. The American

Institutes for Research agreed to provide a staff of research people who had extensive experience in the fields of educational research, development of educational tests and measures, vocational education, technical training, learning and retention.

A project director was appointed together with two associates and other assistants. It was expected that these personnel would be experienced in the research fields of education and educational psychology. One or more members of the staff were to be located in Quincy to maintain continuous coordination with the Superintendent and various members of his staff. The following is a list of key personnel from the American Institutes for Research who were to become involved in the project:

Mr. F. Coit Butler, Project Director, Pittsburgh Office
Mr. J. William Ullery, Project Director, Quincy Office
Miss Vivian Hudak, Associate Research Scientist, Quincy Office
Mr. Boyd Kowal, Senior Research Associate, Quincy Office
Mr. Glen Neifing, Research Scientist, Quincy Office
Dr. Robert M. Gagné, Director of Research, American Institutes for Research
Dr. John C. Flanagan, President, American Institutes for Research
Dr. Edward J. Morrison, Project Director, Pittsburgh Office
Mr. William B. Lecznar, Project Director, Quincy Office
Dr. James Altman, Vice President, American Institutes for Research
Dr. Robert F. Mager, Director, American Institutes for Research

Dr. Victor J. Cieutat, Director of International Studies Institute, American Institutes for Research
Dr. Melvin H. Rudov, Director of American Institutes for Research, Pittsburgh Office
Dr. Brent Baxter, Vice President, American Institutes for Research

Quincy Public Schools. The Superintendent of the Quincy Public Schools, and the Assistant Superintendent for Vocational-Technical Education were to guide the project from a policy point of view (together with an American Institutes for Research representative), advised by the project's panel of advisors and consultants, and by the professional assistance of the American Institutes for Research staff. As stated above, coordinators of instructional development would be employed half-time as members of the school staff. As project employees, they would carry out frequent consultations with selected teachers in the various areas of vocational instruction for review of objectives, selection of relevant materials, and planning of instructional procedures. The following is a list of personnel from the Quincy Public Schools who were to become primarily responsible for or concerned with the project.

Joseph S. Nicastro, Project ABLE Coordinator
Robert E. Pruitt, Superintendent of Schools
Maurice J. Daly, Assistant Superintendent, Vocational-Technical Education
Chester V. Sweatt, Assistant Superintendent, Instruction
Mildred B. Harrison, Director of Guidance and Research

Lloyd M. Creighton, Principal, Quinch High School
John W. Walsh, Principal, North Quincy High School
Laurence H. Babin, Acting Director, Quincy Vocational-Technical School
Kenneth P. White, President, Quincy Junior College

Advisory Panel. A panel of seven scholars was established to meet at intervals throughout each year of the project, for the purpose of reviewing instructional objectives and providing more general guidance to the project. While it was difficult to specify exactly the qualifications these people should have, it was believed they should possess a strong interest in vocational education, an understanding of the needs of the students who may not seek or attain a bachelor's degree, and representative knowledge of education in English, mathematics, social science, and science as basic or related subjects in the vocational curriculum. The following is a list of Advisory Panel members:

Dr. Hamden L. Forkner
Apartment 82
106 Morningside Drive
New York, New York 10027

Mr. Richard B. Ford
Department of History
Carnegie Institute of Technology
Pittsburgh, Pennsylvania 15213

Miss Ann Donovan
Field Administration
Division of Vocational and Technical Education
U. S. Office of Education
Department of Health, Education and Welfare
Washington, D. C. 20202

Mr. Norman C. Harris
Center for the Study of Higher Education
University of Michigan
Ann Arbor, Michigan 48104

Dr. Robert M. Gagné
Professor of Education
University of California
Berkeley, California 94700

Dr. Joseph T. Nerden
Department of Industrial Education
North Carolina State College
P. O. Box 5098
Raleigh, North Carolina 27607

Dr. Robert C. Slack
Department of Humanities
Carnegie Institute of Technology
Pittsburgh, Pennsylvania 15213

Procedures

General Design. An analysis was to be made of the vocations chosen for emphasis in the Quincy programs, to determine what kinds of knowledges and skills were required and likely to be required in the future for these job families. With the aid of panels of consultants including vocational and other educational scholars, sets of objectives would be derived and stated in operational terms for each vocational area, to include those general objectives pertaining to self-fulfillment and responsible citizenship. Following this, curriculum topics would be delineated in proper sequence, to permit optimal flexibility of student programs. Instructional materials would be selected to meet each topic objective, with some new materials to be developed. At the same time, performance measures would be developed in conformity with course and topic objectives. Finally, a plan would be devised to establish procedures for evaluation of the program, including the collection of follow-up data on graduates.

Phases of Work. Behavior analysis. This step was to begin with the collection of job information for representative jobs within the job families chosen for emphasis in the Quincy program, namely:

1. Electro-Electronics
2. Metals and Machines
3. Power Mechanics
4. General Woodworking
5. General Piping
6. Foods Preparation
7. Computer Data Processing
8. Health Occupations
9. Graphic and Commercial Arts
10. Home Economics
11. Business Education

To some extent, detailed information on jobs within these areas was already available as a result of efforts on related projects; however, some new information would need to be collected. It may be emphasized that the details of job performance were not usually available in systematic published form, but would have to be collected and organized.

Beginning with job descriptions, analysis was to be made of performances required for job execution, to distinguish the learnable skills and knowledges from (1) previously acquired basic skills (like hand printing) on the one hand, and from (2) highly specialized and specific job skills (like using a specialized instrument) on the other. Once identified, these learnable entities were to be stated in objective language; for example, "Making rough sketches to show locations of electric outlets within floor outlets." This analysis would include relevant varieties of performances involving personal interaction, such as "Reassures patient concerning discomfort of procedures to be followed in hospital tests" (for a nurse). The results of this analysis would be a set of statements representing the performances required in jobs within each job family. It was expected that work habits and standards of performance would be included as findings of the analysis.

From the statements of required performances would be derived a set of objectives for each course of study. Explicit rationales would be used to relate the learnable skills and knowledges to more general statements which represent the goals of instruction within each department. At this point, the objectives would be discussed and reviewed by a panel of vocational educators and educational scholars, in order to determine their appropriateness and comprehensiveness. The result of this effort should have been a set of clearly understandable goals which could be used for universal communications of course objectives, to educators and public officials, to parents and to students.

Additional consideration was to be given by a panel of educational scholars to some of the broader goals of vocational education which needed to be reflected in a core program of education. These included objectives which might be considered to reflect (1) responsible citizenship, and (2) individual self-fulfillment. These aspects of individual development were not to be neglected within the orientation toward narrow vocational goals. Again, however, the attempt was to be made to derive objectives which would be identifiable and communicable to all concerned.

The areas of the curriculum which were considered to contribute broadly useful capabilities are those of (1) mathematics, (2) science, (3) English, (4) social studies, and (5) the arts. Specific objectives needed to be determined for these subjects which would reflect the goal of establishing broadly applicable and generalizable competencies for the individual student, regardless of his occupational choice.

The description of objectives needed also to make adequate allowances for individual differences among students, and for flexibility of student progress within the educational system. Within given time limitations, for example, students who have elected the electro-electronic course of study should be permitted to progress as far as they can, and not be held back by rigid objectives applicable to particular grade levels. This implied that an ordered series of objectives might be needed, implying recognizably different degrees of progression for different students.

Once course objectives were carefully defined, statements of topics and topical sequences within each course of study could be specified. In a sense, each of these statements may be considered a subordinate objective, consisting of a statement such as "Converts common proportions into decimal numbers." There are two primary reasons for the description of topic objectives. First, such a procedure is designed to insure comprehensiveness of coverage, and precision of coverage, of needed learnable skills and knowledges within the educational program. Second, it is designed to provide for flexibility of student programs of study, to allow for individual student needs and abilities.

Topic objectives were to be reviewed by experienced teachers and vocational educators to insure that they adequately reflected the goals of instruction within each field.

Another consideration for the conduct of instruction in the new Quincy school was important for the success of the program, and needed to be initiated concurrently with curriculum planning. This was guidance and instruction for potential high school students, who were in junior high, with the aim of establishing suitable appreciation of the educational opportunities to be offered by the new school.

This effort was to be a continuing one during the course of the experimental project, but needed to begin with specially prepared information and materials designed to bring about positive attitudes toward the new educational program. The following activities were to be included.

1. Providing in-service orientation and instruction for guidance counselors and teachers at the junior high level, particularly grade 9.

2. School and community information dissemination to emphasize novel approaches to vocational education and the opportunities provided by them.

3. Preparation of materials for use of junior high guidance counselors, providing information for students on the new program and its relation to employment opportunities.

Topic objectives were to provide a kind of detailed set of "course outlines" for which materials of instruction could be selected. The selection would require the active participation of teachers who had extensive knowledge of available materials in each field. The aim of such selection was to obtain the best possible instructional materials, including texts, workbooks and audio-visual presentations, for the achievement of objectives in each topic of the course. The criteria used for selection included the following:

1. Each "unit" of instruction will make possible self-study on the part of the student in attaining specified objectives.

2. Each topic's materials should fit in sequence with others that precede and follow them.

3. It should be possible for the student to identify the objective of each topic and to recognize when he has mastered it.

The kinds of materials selected for each topic would probably vary considerably. Textbook or workbook chapters would undoubtedly be frequently chosen, and may have required some revision to insure their integration into suitable sequences. Consideration was to be given to available self-instructional programs, when appropriate to objectives. In addition, film strips and motion pictures were to be selected to fill particular needs of course structure.

Shop exercises, of course, would also form a part of the materials being selected. In particular, the aim in such selection was to be to insure an optimal arrangement for the practice of skills in the shop, based upon consideration of previously acquired skills and knowledges, either "basic" or "related."

It was recognized that detailed topic objectives cannot always be met by the use of existing materials in their exact form. Revision of these materials would be necessary to accomplish three main purposes:

1. Provide transitional text relating each topic to foregoing prerequisite topics, and to more general objectives of the course.

2. Design for self-study, so that each step in learning is contained within the materials themselves.

3. Provide a means by which the student can determine his own attainment of the objective.

It was believed that materials for some of the topics would need to be newly designed, since it was not at all certain that existing texts of workbooks contained all of the material which would be found necessary on the basis of the analyses previously described. Such materials, too, would be designed to meet the criteria stated above.

Thorough consideration was to be given during this stage of the project to the projected effectiveness of various audio-visual devices as means of accomplishing the desired instruction. Two general classes of device appeared to deserve special attention, namely, inexpensive cartridge-loading film projectors designed for individual use, and simple cartridge loading tape recorders. Both of these appeared to have promising potentialities for technical instruction involving media which present materials did not. More detailed specification of media requirements, however, awaited the planning of instructional objectives. On the basis of such progress, it was likely that support would be sought for an additional project having the purpose of a systematic evaluation of relevant audio-visual media.

On the basis of topic objectives, measures of performance were to be designed to be administered to students as each topic was completed. Such measures of achievement would conform with acceptable test design procedures, but would also incorporate the following characteristics:

1. Measures will emphasize performance, including the performance of basic skills, related skills, and shop skills. Verbal recognition or recitation of verbal sequences will be eliminated except when they are specifically a part of topic objectives.

2. Test items will primarily be designed to assess whether the individual can or cannot accomplish the performances specified by topic objectives. In doing so, they will make the outcome of assessment perfectly clear to both teacher and student.

3. Other test items, carefully distinguished from those of 2. will be designed to assess the "breadth" of student knowledge (that is, its generalizability for the individual student) in relation to specific topic objectives. The purpose of such measurement, in contrast to 2., is to indicate the potential of the student in progressing to advanced parts of the course of study. (Some students need to "branch out," whereas others need to stay on a relatively narrow track.)

4. Emphasis in testing is on the achievement of recognizable goals, rather than upon the differentiation of students into "good" or "bad." In a sense, the individual performances measure is designed to be viewed by the student as something he has to demonstrate he can do. It is not designed to demonstrate that one student is "smarter" than another. (Of course, the measures described under 3. may actually reflect such differences.)

The utilization of instructional materials reflecting realistic topic objectives, together with their associated performance measures, could best be put to use within an educational framework which allowed for great flexibility of student progression throughout a course of study. What this implied is a high degree of individualization of instruction, permitting each student, within established limits, to pursue the course of instruction which best fits his capabilities and interests. Individualized instruction had been accepted as a desirable goal of American education for a great many years. There was every reason that the project should try at this juncture to come as close to achieving it as was humanly possible.

Major Activities of Project ABLE

Five Year Schedule. The following paragraph describes the work activities originally planned for each year of the five year ABLE project.

Year 1. The initial year may be characterized as one devoted primarily to research, designed to yield the organized information needed to carry out the development effort. Vocational information will be collected, and the analysis of this information will be undertaken to yield operationally defined course objectives. These statements will be reviewed by panels of scholars in vocational and general education to determine their realism and comprehensiveness. Following this, specific topic objectives will be derived and reviewed by teachers and other educators. Based also upon these analyses, design and development will be begun on a set of materials aimed at guidance of students in the junior high grades, to prepare them for entry into vocational education. The end of the first year's work should see the completion of course descriptions for vocational, technical, basic and related education applicable to the job families selected by the Quincy Public Schools.

Year 2. This year's work is developmental in character. The major effort will be concerned with the selection and development of instructional materials, as well as the development of new materials where needed. Following such selection, it will be possible to design and develop the rather large number of measures of student performance required for use by teachers in carrying out the program. In addition, a plan will be developed for the instructional procedures needed for individualizing programs of study, which will be reviewed by teachers and educational administrators. Development will be continued on a comprehensive set of materials to be used in guidance of prospective students at the junior high level. Teacher training materials will also be developed for use in summer workshops or institutes conducted to inform Quincy teachers of roles and procedures within the new program.

Year 3. The third year will see the beginning of a tryout of the program within the Quincy Vocational-Technical School. Feasibility of the instructional and measurement procedures will be tested in actual practice, and adaptations made as needed. At the same time, records will be kept of performance scores of individual students, and the initial stages of evaluation will be set into motion. At the end of the school year, revisions will be made in the plan for instructional procedures to be carried out in the following year.

Year 4. An additional year of tryout seems essential for the purpose of refining instructional procedures, as well as the materials and measures employed in the program. The procedure for record-keeping looking toward the conduct of follow-up evaluations in future years will also be established. In addition, data obtained from the first year's tryout will be analyzed and reported.

Year 5. During this year, the primary efforts of the research staff will be devoted to analysis of the data obtained during the second tryout year, and the summarization and interpretation of these data. It is expected that a number of summary reports of the project will be prepared, providing information on the materials and methods employed, as well as on the results of evaluation. The intention will be to prepare these materials for widest possible dissemination. As for the new procedures and materials themselves, it is expected that they will continue to be used, revised, and refined, in the continuing "operational" phase of the program carried out by Quincy school personnel. On the basis of procedures previously established, it should also be possible to carry on a continuing evaluation of Quincy's program of vocational and technical education.

Quarterly Technical Report Summaries. All reports were submitted in compliance with Article 3 of the contract; all summarized the technical progress of Project ABLE during each specific quarter of operation from April 1965 to September 1970. (See Appendix F.) Appendix F contains a summary of each quarter relevant to specific technical areas.

Summary. In this historical review of Project ABLE, a need for a major vocational curriculum project was illustrated and the events leading to ABLE and the development and content of the proposal funded by the U. S. Office of Education were reviewed. The stated goals and planned outcomes were detailed. Local, state and national participants were noted and project design, work phases and schedules have been explained. Summaries of some eighteen technical reports provide an overview of tasks accomplished over the 1965-1970 period of the project. In addition, the writers role as Project Director has been documented.

The Military Instructional Systems Program

Introduction. The systems approach is a relatively recent development. It began in the Air Force during the 1950s when research and development organizations concerned with ballistic missiles and space launch vehicles were brought together to meet the challenge of the space age. Collectively, these agencies were responsible for the overall weapon system development, its equipment components, and its human component. As work began, it became apparent that the human element had to be carefully considered for every phase in the life cycle of the system; from conception to obsolescence. Personnel had to be identified, selected, and qualified to function in a manner that was compatible with the design characteristics of equipment still under development. In addition, the qualification of personnel for assignment into these systems had to be time-phased to coincide with the needs of the operational system. These situations required the use of a systematic approach to the development of instruction.[55]

Definitions. Once again the reader may wish to examine definitions of terms before proceeding. (See Appendix G.) Military terminology for instructional systems processes differs somewhat from those of ABLE.

Instructional System Development Concept. Education and training personnel have traditionally approached the task of curriculum planning and development in a logical

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[55]Department of the Air Force, "Instructional System Development," Air Force Manual 50-2, Air Training Command, 1963, pp. 1-2.

and organized manner; that is, systematically. Being systematic, however, is not the same thing as applying a systems approach. The semantic confusion concerning these two terms is unfortunate since it sometimes provides a false sense of accomplishment. A systems approach focuses upon a set of objectives, ends to be achieved to solve specific problems. These objectives or requirements are derived through an analysis of the operational system to be supported. To be sure, there are constraints that must be considered parameters within which solutions to problems must fall, and limitations of resources. The systems approach does not interpret constraints as an excuse for mediocrity, but responds to these constraints by organizing the available technology, manpower, and money, within a specified time frame, to reach established objectives. In short, the systems approach is a management tool which directs the actions required for cost-effective achievement of the specified objectives.[56]

The steps used in the design, development and testing of a typical Air Force weapon system can be illustrated. (See Table 1.) An examination of these steps reveals the necessity for deliberately following an organized plan in establishing and conducting an instructional program. This plan begins with the determination of job performance

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[56] Ibid.

requirements - a requisite for producing qualified personnel.[57] From these requirements, jobs are designated and tasks identified for individuals or groups of individuals. A task analysis is then accomplished to determine the types of behavior needed and how each should be acquired. At this point, surveys or pretests are often developed and administered to determine what behaviors (knowledges and skills) are already possessed by the prospective student population. Based on the results of these tests, courses are selected or developed. Required instructional devices must be identified and designed with sufficient lead-time to insure that delivery dates can be properly time-phased with the course start date. Instruction must be conducted to provide students with predetermined performance abilities. Evaluation of students is required to determine if prescribed levels of proficiency have been attained. After students complete the instructional phase, equipment and personnel are brought together for operational readiness training and system evaluation. The successful completion of this phase produces an operational Air Force System.

Application: The application of the systems approach to Air Force education and training programs is one of the most significant developments of recent decades. A variety of titles are used to refer to the systems approach

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[57] Ibid., pp. 1-3.

as applied to education and training. Among these are: Instructional System Development, Instructional System Engineering, and Systems Approach to Training.[58] Under the concept of the systems approach, existing education and training programs can be revitalized and new programs developed which insure that students acquire the performance abilities needed for future assignments. This does not imply that an entirely new concept of education and training has been developed, but that a new methodology (or technology) has been applied. The process, described in the preceding paragraph, for developing the human component of a weapon system has been combined with other evolving education and training technologies to form a methodology for instructional system development.

An instructional system is an integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques, and procedures performing efficiently the functions required to achieve specified learning objectives. The application of the systems approach to the planning and development of an instructional system involves more than the use of current innovations in media and teaching techniques. The instructional system designer must insure that education and training programs are not bound by traditional procedures, techniques, or routines of

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[58] Ibid., pp. 1-4.

the day. Instead, careful consideration must be given to both current and future needs when identifying and planning instructional activities or experiences, and when identifying instructional media, equipment, and facilities. The instructional system must produce graduates who are not bound by fixed habits, procedures, or attitudes, but are able to apply what they have learned to new and changing situations.[59] Therefore, the process of applying the systems approach in instructional system development is the orderly process of (1) gathering and analyzing job performance requirements; (2) translating job performance requirements into behaviorally-stated learning objectives; (3) identifying, developing and integrating operating resources, instructional techniques and procedures, based on effective technological advancements in education and training, to provide the required instruction; and (4) assuring achievement of behavioral objectives and confirming that these objectives fully support the job performance requirements.[60]

Model for Instructional Systems Development. This model prescribes an approach to the planning and development of instruction that is adaptive to all education and training programs. It is composed of logically interacting

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[59] Ibid.

[60] Ibid.

steps. (See Table 2.) Each step is intended to provide the input needed to accomplish a later step(s). Although portions of several steps can often be accomplished simultaneously, the interaction between the steps may make it necessary to reaccomplish all or a portion of a previous step when it does not provide sufficient input. The application of the systems approach often requires a series of compromises. Instructional systems, like all other Air Force systems, must arrive at the best possible combination of desirable features and alternatives. These features and alternatives are then considered and, on the basis of objectives and limiting factors, the most cost-effective alternative is selected. The following paragraphs provide a brief overview of the steps in the model for instructional system development.[61]

Step 1 - Analyze System Requirements. The Air Force utilizes many types of systems, each with unique characteristics that affect the performance of tasks. The development of the human component of these systems must be carefully planned and based on the operational requirements of the system. Prior to developing instruction, the instructional system designer must become familiar with every aspect of the operational system. Therefore, analytical studies concerning the man-machine relationship and the

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[61] Ibid.

inputs and outputs of subsystems form the starting point for instructional system development. Analysis of system requirements not only identifies the job(s) to be performed, but places each job in perspective with objectives, requirements and the overall environment of the operational system.

Step 2 - Define Education or Training Requirements. This step represents the first major decision required in planning and developing the instructional system. Based on job performance requirements, decisions must be made concerning methods for acquiring qualified personnel. If it is decided that instruction is the most cost-effective method, a determination must be made as to the duties and tasks requiring instruction and the degree or level of proficiency to be developed. Decisions required during this step are influenced by numerous factors. Among these are: the number of personnel to be qualified, the time required to develop the instruction, the criticality and learning difficulty of tasks, and the availability and qualifications of personnel to develop and place the instructional system into operation. In addition, the resources needed to develop the instructional system, as well as those requiring lead-time for development and installation, must also be identified during this step.[62]

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[62] _Ibid._, pp. 1-5.

Step 3 - Develop Objectives and Tests. The process of developing instructional objectives and tests begins with the identification of behaviors (knowledges, skills and attitudes) required for successful job performance. Based on the behaviors identified, criterion and enabling objectives and tests are developed. Criterion objectives specify those behaviors desired as an end-product of instruction, the conditions under which the behavior is to be demonstrated, and the acceptable standard of performance. Enabling objectives prescribe prerequisite knowledges and skills that are essential to the attainment of criterion objectives. Following the development of objectives, criterion tests are constructed to evaluate student achievement of criterion objectives and to prove the effectiveness of the instructional system. Tests based on enabling objectives measure the student's progress toward achieving a criterion objective. This step also involves the construction of tests, such as aptitude, diagnostic, survey, or pretest which may be of use in determining what basic knowledges and skills the prospective student already has within his repertoire.[63]

Step 4 - Plan, Develop and Validate Instruction. The accomplishment of this step requires the careful planning of instruction to satisfy learning objectives. This

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[63] Ibid.

involves the sequencing of learning activities or exercises in an order that produces the required learning in the shortest time. It also involves the planning or selection of instructional methods, media and equipment which most effectively support learning objectives. The accomplishment of these planning activities will provide the information needed to identify resource requirements. This step also involves the development and validation of instructional materials. In addition to proving that instructional materials teach what they are designed to teach, validation is conducted to insure that all elements of the instructional system function effectively in achieving stated objectives.[64]

Step 5 - Conduct and Evaluate Instruction. This final step is the most important in terms of continuing success of the instructional system. Despite the constant efforts of everyone involved in its design, a newly implemented system seldom attains all of its stated objectives. Improvement or redesign is, then, an integral part of the instructional system development process. Student attainment or nonattainment of learning objectives is the primary method for evaluating instruction. This method usually provides the most direct identification of problem areas and the corrective actions needed. The evaluation process

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[64] _Ibid._, pp. 1-6.

must also insure that the product of the instructional system (qualified personnel) meet the requirements of the operating commands. That is, can the man do what he was taught to do? Therefore, if instructional effectiveness is to be maintained, the evaluation processes must be carefully applied to every aspect of instructional system development.[65]

Summary. The systems approach provides a methodology for the orderly development or revision of Air Force education and training programs. When conscientiously applied, the systems approach insures cost-effectiveness instruction that produces graduates capable of successful job performance in their future assignments. The concepts and procedures of instructional system development are to be applied as an integral part of the continuous evaluation and improvement process that naturally occurs within an instructional program. The application of the systems approach to education or training is but one of the phases in the never-ceasing search for a more efficient and effective Air Force.

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[65] Ibid.

CHAPTER IV

JOB ANALYSIS AND TASK ANALYSIS FOR THE DERIVATION OF BEHAVIORAL OBJECTIVES. PROJECT ABLE COMPARED TO THE MILITARY MODEL

Job Requirement Data

This thesis focuses on selected components of Project ABLE. This section concentrates on that component of ABLE dealing with the derivation of objectives. The procedures for gathering job requirement data for use by Air Force instructional system planners are described in the following paragraphs.

Occupational Survey. The occupational survey is the Air Force procedure for the identification of the duties and tasks which comprise one or more shredouts, prefixes, specialties, career field ladders, or utilization fields; and for the collection, collation and analysis of information concerning such duties and tasks. Occupational surveys obtain, from large numbers of job incumbents, information about the duties and tasks they actually perform. This information is then tabulated and computer analyzed with the results prepared in the form of an occupational survey report. These reports have revealed many new tasks not previously known to be performed by personnel in a particular specialty.

Questionnaire. The questionnaire is a method for obtaining job requirements information by means of mail surveys. It requests the job incumbent to provide certain background information and describe his job in his own words. When describing jobs, the individual is asked to identify the duties and tasks he actually performs and to list the materials, tools, and/or equipment used. Incumbents are requested to work independently when completing the questionnaire. However, supervisors may be asked to verify responses before the questionnaire is returned to the originator. This procedure is designed to add comprehensiveness, objectivity and validity to the information presented. Perhaps the chief advantages of this survey method are (1) that no structured forms are used and (2) the mail is used as the medium of communication. Both these advantages fall within the realm of economy. Among the disadvantages is the difficulty in correlating the relatively unstructured, hand-written information. Another disadvantage is that the questionnaire method places a heavy demand on recall. Thus, the forms are often incomplete which increases the possibility of sampling errors.

Checklist. This survey method differs from questionnaire method in that the checklist contains a listing of duties and tasks believed to describe the specialty or a position within a specialty. The duties and tasks listed are based upon information obtained from specialty descriptions, instructional standards, job proficiency guides, and procedural or technical publications. In this type of survey, the individual is asked to identify, usually by means of a check (✓), the duties and tasks he performs. The results of the survey are compiled to form a job inventory for the specialty or position. The use of the checklist makes possible group administration of large samples of incumbents, thus making job requirements data available rapidly and economically from widely representative populations. The responses to the checklist are adaptable to machine tabulation and the application of statistical analysis techniques. However, a number of problems are inherent in the checklist method of conducting surveys. One of these is the difficulty associated with constructing checklist items which clearly communicate to the incumbent the exact nature of the duty and task assignments. Another disadvantage is the ineffectiveness of the checklist for obtaining information relative to the sequence of task performance or the relationship among tasks.

Individual Interview. In using this method for collecting job requirements data, a number of representative (typical) workers are selected for interview. Those selected are interviewed concerning the duties and tasks they perform. Interviews are conducted on an individual basis, usually away from the work situation, and the information obtained is recorded on standardized forms. When all the interviews are completed, the information is consolidated into a single job inventory. One of the advantages of the individual interview method is that it usually yields a better quality of information than the questionnaire or the checklist. Among its disadvantages is the time required to conduct the interviews and compile job requirements data.

Observation Interview. This method is similar to the individual interview except that it takes place at the work site. While the worker performs his assigned duties and tasks, the person gathering the information asks questions about the work being done and records the information. As a result, the information obtained is more specific, more complete, and more accurate. Of the methods described, the observation interview is preferred because it reveals unique tasks and provides a better understanding of the work performed. Disadvantages are (1) the relative slowness in obtaining data, and (2) the interview inevitably interferes with operational activities. Thus, the observation interview costs more than the previously described methods.[66]

The procedures used for gathering job requirement data for Project ABLE followed quite closely the Air Force

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[66]Department of the Air Force, "Instructional System Development," Air Force Manual 50-2, Air Training Command, 1963, pp. 2-7.

methods outlined above. The following paragraphs summarize the ABLE processes.

A content analysis is a process whereby available instructional materials such as textbooks are used as the primary source of information for the derivation of behavioral objectives. Many authorities agree that the content analysis approach is the worst possible way to develop instructional objectives.

A simulation process can be accomplished with the type of procedural manuals described in earlier paragraphs along with equipment instruction documents, repair standards and specifications, etc. Depending on the complexity of the task, the simulation could be performed with or without the replication of the actual situation and environmental conditions.

The interview approach frequently involves the use of prestructured instruments with much frequency data collected through a question-answer process. Often such instruments are used as mailed questionnaires. Employers, supervisors of persons undergoing investigation, experts, teachers, and others, in addition to the population being analyzed, can be involved at various levels of information collection. This method is often used to validate job tasks, job conditions, or job standards through a frequency count of information collected during simulation or observation.

Observation methods are usually associated with the more rigorous clinical type of analytical process. The technique usually requires the services of trained clinical psychologists.[67]

Task Enumeration

ABLE task enumeration procedures for a particular specialty, were nearly identical to that of the Air Force. The Air Force method was to obtain data on thousands of personnel performing in the field and then apply two criteria to determine which tasks should be included within a training course. The two criteria were:

Number Performing the Task. This factor can often be used as a basis for identifying tasks for inclusion in an instructional standard. For example, it can be reasoned that a task performed by a majority of the job incumbents should be included in the instructional standard. Similarly, a task performed by only a minority would be excluded. However, a logical basis for either including or excluding a task is not so readily available when the task is performed by fifty percent of the incumbents. Thus, a second factor needs to be taken into consideration.

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[67]U. S. Office of Education, Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, Management and Evaluation Plan for Instructional Systems Development, 1970, p. 54.

Criticality of the Task. Criticality refers to the relative importance of a task to mission success as compared to the importance of other tasks. In determining whether a task should or should not be included in the instructional standard, criticality is sometimes more important than the number performing. For example, a task performed by a small number of job incumbents might arbitrarily be excluded from the standard. Yet, further analysis may reveal that an inability to perform that task in a precise manner, when the need arises, could have a serious impact on the organization's mission capability. The point to be emphasized is that the "best judgment" decision is made on the basis of both the number performing and the criticality of the task.[68]

Project ABLE personnel utilized the two factors described above in determining the tasks to be included in the three ABLE curriculums of electronics, woodworking and power mechanics. In the case of power mechanics, the entire task enumeration was a result of an earlier Air Force survey. The following direct quote from the ABLE 12th Technical Report bears evidence to that fact.

> In addition, a task enumeration computer printout secured from the Training Center at Lackland Air Force Base, was most valuable. An analysis had

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[68]Department of the Air Force, Instructional Systems Development, Air Force Manual 50-2, Air Training Command, 1963, pp. 3-5

> been made of automotive and vehicle service activity at all major repair and service sites. It was possible to identify and remove those activities related only to military equipment and components. It should be noted here that most of the ground passenger vehicles used by the Air Force are standard production units. The analysis identified the frequency with which each task was performed, the percentage of time spent on each type task, the percentage of time spent on each task by grade level, time requirements, and other information.[69]

Once the tasks related only to Air Force activities had been removed, the remaining tasks became the proposed ABLE Power Mechanics training course. (See Table 3.)

Objective Nomenclature and Characteristics

As might be expected, Air Force and ABLE objectives were known by different terms. Where the Air Force used the name criterion, ABLE specified course, thereby recognizing the on-going structure of public schools. However, the descriptions of both sets of objectives are nearly identical.

Within the Air Force Training Command, the objectives of instruction were based directly on an analysis of task and knowledge statements derived from the job performance requirements. Within the systems model, the objectives represent the output which can be expected from the

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[69] U. S. Office of Education, Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, The Power Mechanics Curriculum, 1969, p. 11.

instructional system.

Criterion objectives must be stated in terms of behavioral end-products, that is, in terms of what the student must do. These objectives include the operations he must perform and the knowledges he must acquire in order to satisfy job performance requirements.

Characteristics. Criterion objectives specify student behavior, the conditions under which this behavior will occur, and the standard or criterion of acceptable performance. Objectives stated in this manner provide a solid base upon which to build an instructional system.

Performance/Behavior. An instructor cannot read the mind of the student to verify the extent of his understanding. It is only through some overt activity on the part of the student that the extent of his knowledge or skill can be measured. To say that a student will "develop an understanding of Ohm's Law" can be used as an example of an obscure objective. One person may feel that if the student recites the law it indicates understanding. Another may say that the student should explain the law. A third may contend that the only way the student can satisfy this objective is for him to use the formula to solve problems in electrical circuitry. A more precise objective could read that the student will "use Ohm's Law to determine applied voltage when amperage and circuit resistance are known." An objective, so stated, lets the student, instructor supervisor, measurement personnel, writers and course managers know exactly what the student is to learn, and what behavior the student should exhibit to demonstrate satisfactory achievement. Use of action verbs reduces ambiguity and promotes the understanding of instructional intent.

Conditions. A properly prepared objective also clearly states the limits and/or conditions within which the student will be expected to perform. This portion of the objective describes the important aspects of the environment in which the behavior will be performed. What does the student have to work with? Can he select his own tools? Is he allowed to use notes he has taken on the subject? Are technical orders or checklists available to him for guidance? What information will be provided as a starting point? These are typical questions which must be considered before a criterion objective can be put into final form. A well-written objective makes clear the conditions under which the student will work. It will also describe what the student will be provided to perform the task.

Standard. A third requirement of a well-prepared objective is a clearly stated or implicitly implied standard of performance. This standard serves as the criterion for determining whether the student has achieved a satisfactory level of performance.[70]

The three components of the Air Force objective, behavior, conditions and standards, were those proposed by Robert F. Mager in his book "Preparing Objectives for Programmed Instruction." The same book was furnished to objective writers on Project ABLE as a guideline for development of vocational objectives. Mager, during this period of time, was a consultant to the Air Force's Air Training Command and later, was on the board of the American Institutes for Research, the co-sponsor of ABLE.

In addition to using the same guidelines as the Air Force for objective development, ABLE personnel secured and used an entire set of electronics objectives developed by Lowry Air Force Base. The course was described in ABLE's Eleventh Quarterly Technical Report as follows:

> The course in its present form consists of 54 sequenced projects based upon 171 objectives. Each project provides the student with the objectives, equipment and material requirements as well as the step-by-step procedure to accomplish the objectives.[71]

The objectives were listed in the Report in detail. (See Appendix H.)

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[70] Department of the Air Force, Instructional Systems Development, Air Force Manual 50-2, Air Training Command, 1963, pp. 4-5.

[71] U. S. Office of Education, Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, The Electronics Curriculum, 1969.

In summary, it has been shown that task enumeration procedures and the derivation of objectives for Project ABLE not only evolved from procedures similar to those of the Air Force, but in many instances, were the exact materials developed by and used in Air Force Training Courses.

CHAPTER V

INSTRUCTIONAL SYSTEM DEVELOPMENT AND VALIDATION

Criterion Examinations

A brief definition of norm-referenced and criterion referenced examinations follows. Both Air Force and ABLE instructional technology called for criterion referenced items.

Norm-referenced examinations, frequently referred to as tests which are "graded on a curve," evaluate a student's proficiency in terms of a comparison between his performance and the performance of other members of the group. Norm-referenced measures equate the proficiency of one individual with that of another, but have little value in measuring their proficiency in relation to performance standards. Although norm-referenced tests are useful in providing a relative standing among students, they have limited value as a quality control for the evaluation of the effectiveness of an instructional system. For this reason, one or more criterion test items should be prepared for each criterion objective, based on what the student should be able to do, under what conditions, and to what standard of proficiency. The difficulty, complexity, and scope of instruction necessary to satisfy a criterion objective should be assessed in order to determine the number of test items required.

The differences in Air Force and ABLE procedures for developing criterion items were slight. The following describes Air Force processes.

Each test item should be based solely on the requirements specified in the criterion objective which the item is to measure. Most courses present a certain amount of instruction on the learning of theory, principles, and background information. However, criterion objectives are based on a detailed analysis of job performance requirements, and a further analysis of each task to be included in the instructional system. Therefore, the possibility of "nice-to-know" instruction is eliminated. Once it is determined that all criterion objectives are essential, an examination should be prepared which will measure each objective within the parameters established by the objective. To show that he has attained the objective, the student must either meet or exceed the specified standard of performance. In fact, the wording in both the test item and the objective may be identical. In an automotive course, for example, one may find the following criterion objective: "Using an electrical test set, adjust the voltage regulator until the voltmeter indicates 14 volts, within a tolerance of $\pm$.2 volt." In this case, the objective itself is a good test item; in others, some rephrasing may be necessary. In any case, a test item should require students to respond only as specified, under established conditions, and with the minimum level of acceptable performance. In the objective cited above, the student is expected to perform the task. The corresponding test item should require identical performance by the student - not merely have him state the procedures that are involved in the adjustment of the voltage regulator.[72]

Now, consider the following ABLE statement on the development of performance or criterion measures.

> The main consideration in test design was, and continues to be, vocational competence. This can be measured by testing student performance on each objective upon completion of a unit. A training objective restated as a performance test item will provide the most relevant test because it describes the criterion behavior, conditions, and acceptable performance. Care is being taken to insure that the test response duplicates the behaviors required in the stated objective. Questions which require verbalization about a desired performance, rather than the performance itself, have been avoided as much as possible.[73]

The similarity of wording was due to more than the fact that Air Force psychologists had helped pioneer performance measurement and that ABLE personnel were attempting such tasks several years later. The author of the above ABLE statement had in fact, been given training and materials by a former Air Force Instructional Systems Development Team Chief, F. Coit Butler, who was Project ABLE

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[72] Department of the Air Force, Instructional Systems Development, Air Force Manual 50-2, Air Training Command, 1963, pp. 4-9.

[73] U. S. Office of Education, Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, The Electronics Curriculum, 1969, p. 10.

Coordinator for the American Institutes for Research.

Instructional Trial

Although Air Force and ABLE tryout group sizes varied slightly, the processes were nearly identical. First, the Air Force procedures.

The reason for trying out instruction on a group of students is to determine how that portion of the instructional system functions under conditions approximating the actual classroom situation. Then too, it is more economical to gather data concerning the effectiveness of instruction from groups than it is from individuals. Therefore, validation efforts are expanded to small groups of 6 to 10 students as soon as satisfactory results are obtained with individual tryouts.

The first small group sampling should be continued until a total of 20 to 30 typical prospective students have been presented the instructional sequence. The students selected for this phase of validation should also represent a sample of the intended target population. The selection should include, insofar as possible, an even distribution of low, average, and high aptitude students.[74]

Project ABLE's procedure follows:

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[74] Department of the Air Force, Instructional Systems Development, Air Force Manual 50-2, Air Training Command, 1963, pp. 5-20.

Through this stage, it will be necessary to cycle (test/revise/retest) each module several times with groups of two to five persons. (It should be understood that during the process of testing and verifying criterion modules, that the objectives will again undergo verification.) From experience, two to three cycles will be required for each module before field testing can take place.

The tryout will provide much valuable information including that related to reading level, terminology, safety and organization.

Within each module, it is expected that experienced trainees will get approximately 85% of the test items correct on validated instruments. During the validation stage, the instruments should be modified until such a standard can be attained."[75]

Learning Environment

In Chapter IV and so far in Chapter V, it has been shown that the mechanical processes for deriving job data requirements, task enumeration, objectives, criterion examinations and tryout of materials were similar or identical for Air Force and ABLE training programs. But what of

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[75] U. S. Office of Education, Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School, Management and Evaluation Plan for Instructional Systems Development for Vocational-Technical Education, 1970, p. 70.

the learning facility? Were the roles of instructors and students within the military and public school environments to be the same? The following paragraphs describe Air Force intentions in the early sixties.

Instructors and students should view the advances in instructional methodology with enthusiasm. The instructor will be afforded opportunities for greater creative effort. The student will acquire a sense of personal accomplishment seldom before possible. As developments in the concept of individualized instruction take hold, the instructor will become increasingly more professional. He will no longer be bound in the traditional role as a dispenser of facts and data. He will be able to devote most of his attention to the problems and needs of the individual student. Under this concept, the instructor truly becomes a "manager of learning." As such, he will be assuming two main roles: a classroom administrator and an individual tutor and counselor.

Despite sophisticated hardware and innovations, the instructor's part in the learning process will never be just incidental. There will always be a need for personnel to design the learning environment; to determine the most appropriate teaching-learning activities for the development of specific skills and knowledges; and to motivate, direct, guide and evaluate students as they engage in these activities.

Since no two students have the same learning patterns or prior knowledge and experience, the instructor will be responsible for developing individual study plans. He will focus his attention on the requirements of the individual, rather than the group. This will lead to the structuring or programming of subject matter based on the needs of the individual student toward the accomplishment of course objectives. The individual study plans should allow for flexibility in scheduling, revision and consolidation when group efforts are required.

The instructor should insure that instructional materials, equipment, aids and other supplies are readily accessible to the students. He should make certain that the equipment and aids function properly, and assist in the retrieval of information as necessary.

The instructor should also make sure that each student is progressing according to his capabilities and within the pre-planned scope of the teaching-learning activities. If weaknesses are discovered through an analysis of evaluation data, the student's activities may be rechanneled to remedial sequences or the instructor may provide individual tutoring. The success of each instructional segment should be continuously evaluated as a quality control measure. If deficiencies in student performance keep recurring, the instructional segment involved should be analyzed for possible revision.

Among the many skills that the instructor needs to possess is that of an individual tutor and counselor. Quite naturally, the student looks to his instructor for guidance, encouragement and suggestions for improvement. Therefore, it is the responsibility of the instructor to satisfy these needs.

From a practical point of view, it is almost impossible to design an instructional system that will anticipate and provide for all the needs of all the students all the time. Some students will always have trouble meeting certain objectives, understanding individual points, and performing certain tasks. The trouble spots will be different for different people. The instructor must be alert for such problems and be prepared to provide assistance where needed. The instructor, no doubt, will have students who are exceptionally fast or unusually slow. The more capable student can be kept from becoming disinterested and bored by applying one of several acceleration techniques. The instructor must also diagnose the problems of the less capable student. Through an observation of student progress and the use of diagnostic and achievement tests, the instructor can obtain valuable information for the purpose of tailoring instruction to meet individual needs. This may include providing supplementary materials or remedial instruction.

Motivation probably contributes more to the learning process and to the student's future success than any other single factor. It is the instructor's reponsibility to enhance motivation. This is especially necessary in individualized instruction since the student assumes a more autonomous role in the learning process. Without a desire to learn, there is little probability that adequate learning will occur. Therefore, the instructor must develop techniques which will encourage the student to want to learn. One of the best ways of stimulating a student toward greater individual effort is to insure, insofar as possible, that his endeavors meet with success rather than failure. Successful achievement usually will promote intrinsic motivation, and tends to strengthen the student's self-determination.

The process of providing guidance or of counseling individual students may be a new role for some instructors, yet in individualized instruction it is a most important function. Unfavorable attitudes, opinions, or emotions can have a very detrimental effect on a student's ability to learn. On the other hand, when such attitudes, opinions, and emotions are favorable, a healthy climate for learning is established. Most people are receptive to a good listener. So, when interacting individually with the students, the alert instructor can often detect the presence of personal problems and, through interviews, aid the students in overcoming their difficulties before the problems can seriously affect learning.[76]

What were the ABLE approaches to the learning environment in the late sixties? Described below is the ABLE rationale as put forth by one of the former curriculum developers during a personal interview.

> It is evident that certain behavioral changes were required by students participating in the program. They were given a great deal of responsibility for their own learning. The students were required to meet standards and to demonstrate capabilities in ways not common to traditional type programs. Their relationship with the teacher had changed as well as the way in which they received instruction. Certain behavioral changes were also required of the teacher. He was no longer the lecturer and major source of content and procedures. He worked primarily with individuals on a face-to-face basis in situations where a wide variety of activities are likely to take place. The new role is often described as that of a "manager of learning." He is, in effect, a course administrator and an individual tutor and counselor.
>
> The systems approach requires a very carefully managed program. The development is precisely engineered throughout all phases. As a result, rather specific tasks and duties are required of the manager-teacher. While effective management is essential, the instructor's role as an individual tutor and counselor is the more important. The ABLE courses as prepared, cannot take care of all individual needs and differences. Flexibility has been provided and alternatives must be exercised whenever possible. The instructor must be aware of trouble spots and ready to provide assistance where necessary. Some students will progress very fast, others will go too slow. The extremes must be serviced and the minor differences left to the ingenuity of the teacher.

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[76] Department of the Air Force, Instructional Systems Development, <u>Air Force Manual 50-2</u>, Air Training Command, 1963, pp. 6-7.

> Lecturing and mass demonstrations, as the major vehicles of instruction, are not appropriate with the new system. On the other hand, large group and small group sessions have a valuable function if used properly. Special demonstrations by community resource persons and vendors are always useful. Sessions for occupational and employment information and the viewing of some excellent films available on the industry, are certainly appropriate group activity. Discussions on topics or problems such as those affecting the industry should be a part of every program. ABLE materials are not intended to be the sole source of student educational experiences. Enrichment activities, citizenship instruction, attitude development, occupational information, career counseling, etc., will require the services of a professional educator interested in the welfare of his students--as individuals.[77]

The tasks then, for ABLE instructors, were to: Assure availability of lesson materials, components and equipment; evaluate the progress of each student to determine if objectives are attained to stated levels of proficiency; provide assistance, when needed, to enable each student to progress without undue loss of training time.

Again, the similarity between Air Force and ABLE procedures were occuring, to a large extent, because of personnel background. The person interviewed above, Glen E. Neifing, former American Institutes for Research employee, had contributed much to the design of the ABLE instructional system development process and was a former civilian employee of the Air Force. He had, during his

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[77]Interview with Glen E. Neifing, Regional Manager of Instructional Systems Development for New England Resource Center for Occupational Education, September 5, 1972.

assignment as an instructional systems development specialist, designed, implemented and evaluated instructional media, materials and systems for young (18-21) Air Force trainees.

In summary, it has been shown in Chapters IV and V that ABLE development was patterned on processes developed and proven in the Air Force. The connection of Gagné, Mager, Butler and Neifing to both Air Force and the American Institutes for Research had much to do with the ABLE curriculum being of a design quite similar to that of the Air Force.

CHAPTER VI

ASSESSMENT OF ABLE PROCESSES AND PRODUCTS

Internal

Student, instructor and project staff assessments of ABLE processes and products were an integral part of the development and evaluation process. The following paragraphs describe in detail, the testing and assessment of one typical set of curriculum materials, Power Mechanics. All other materials were developed utilizing equally rigorous procedures.

Power Mechanics performance evaluations, and learning units, were developed during the summer of 1968. They subsequently underwent two thorough revisions on the basis of tests conducted during the first and second semesters of the 1968-69 school year. Development in the Power Mechanics area was restricted primarily to the first exit level. Since the Project, in general, was experiencing difficulty in establishing operational programs on a rather large scale, a pilot model seemed appropriate. It was therefore decided that the first level basic program would be revised and modified until all major problems were solved. An efficient, functional and well-organized operational program as a model became the prime requisite to any further development not only in Power Mechanics, but in other vocational areas as well.

The test population were tenth grade vocational school students who had elected the Power Mechanics family for occupational training. The tenth grade class was composed of two groups (17 to 19 students per group) assigned to the area for three periods of shop each day. One group was scheduled to the auto body area, the other to the auto mechanics area. The groups were switched at mid-year, enabling all students to gain experience in both areas. For those students who had definite career choices and strong preferences for one area over the other, special provisions were made. For example, at least seven students who identified closely with the auto body area (and were strongly opposed to spending a complete semester in the auto mechanics area) were assigned only those tasks which were common to both sub-families. Upon completion of the common tasks, such students returned to their area of preference.

Approximately 25% of the students had gained some experience through summer or after school jobs as service station attendants or similar occupations. On the other hand, the instructors estimated that approximately 25 to 30% of the class members had little or no experience in the job area. Such students demonstrated difficulty with the basic tools and nomenclature and displayed no more knowledge about vehicles than one would expect from the general population of vocational students. (Power Mechanics was not offered as a part of the Quincy junior high program.) The remainder of those questioned claimed varied experience such as work on small engines, watching and helping relatives or friends on tune-ups and mechanical work, helping around garages and service stations, etc.

Two instructors and one American Institutes for Research scientist were assigned to the test program. The initial plan called for an approach drawing on case study methodology with the primary focus on the two groups, "experienced" and "non-experienced." Each unit was tested with several students in each of the two groups. The same materials were also used with the remainder of the class. In addition to testing performance evaluations, learning units which had been prepared during the summer, were implemented and tested.

The students in the "non-experienced" group (naive population) were unable to perform the tasks required by most of the performance evaluations. In many instances the tools and equipment were damaged and safety became an important consideration. The test indicated very quickly that training was required and that most items included in the instruments were necessary and not redundant. While many deficiencies were pinpointed, most were problems of clarification -- especially in the behaviors required to meet the objectives. Students in the group identified as having had "some experience" in the job area, also demonstrated considerable difficulty with most evaluations.

The instructor time required to supervise performance evaluations without some prerequisite instruction was simply not practical with the majority of the inexperienced students.

The third or "experienced" group demonstrated limited success on most tasks and topic objectives. Their major problem areas were: work and safety procedures, identification of critical specifications, proper use of tools and equipment, and the use of manuals prepared for service station attendants and mechanics. (This tended to confirm some of the serious criticisms of the industry.) An example would be the fact that no student checked tire inflation specifications before making adjustments on various vehicles. Such seemingly minor procedures are actually quite critical considering the safety factors of high speed driving under differing load weights and conditions. Operations requiring the use of torque wrenches were universally ignored as were many other practices which are cause for alarm. It was also evident that most students, including those from the "experienced" group, had learned many "bad" and unsafe practices from supervisors, fellow employees and friends who either lacked proper training or failed to use proper procedures. The methods used in establishing standards were reaffirmed.

The initial test was terminated after the third month of operation. All student materials were collected, including instructor checklists. Much of the information for revisions came from master correction copies maintained by each of the three researchers. While the number of students attempting each unit varies from only 4 to 13, the frequency data, when supplemented with the detailed comments from students and observers, yielded much valuable information. It was found that the technique of intensive observation (and comparison of students from each of the three groups) was an effective and appropriate method for the initial developmental stages. A careful examination of student responses on each unit and interviews after each unit was completed, were also quite useful. Forms were used to assess student and instructor reactions and opinions. (See Appendix H.)

One of the tasks of the research scientist was that of observing group interactions. This proved most valuable in identifying problem areas such as those dealing with laboratory and course organization. For example, one of the major hurdles faced in the implementation of the individualized and self-paced program was that of providing an effective way of administering the performance evaluations. Methods had to be identified for shifting of the responsibility for the grading of test items to the students. Effective instruments had to be developed which would reduce paper work for the instructor while still enabling frequent and effective monitoring and evaluation of each student's progress. As a result, student self-scoring, self-response cards along with improved instructor checklists were developed. These proved quite effective during the second test. The self-response cards also provided a practical means of performing an item analysis on each of the questions included in the evaluations. (See Appendix I.)

The second phase of development centered about two major activities: (1) The objectives, performance evaluations, and learning materials were completely revised and rewritten. Modification of objectives primarily dealt with problems of clarification. (2) The shop was completely reorganized with a new system of tool control, development of needed training aids and mock-ups, assembly of parts and materials required by the evaluators (e.g. samples for those objectives which required students to differentiate between various good and defective components) and other critical environmental management problems.

The second test was postponed for nearly four weeks after the start of the second semester. The reason for the delay was a decision not to initiate a controlled experiment until all training aids, tools, equipment, audio-visual teaching aids, and other items were in place and operational. Procedures followed during the second test paralleled those established for the first attempt. The improvements incorporated during revision and reorganization resulted in a greatly improved learning environment. Student attitudes and work habits improved. Discipline problems declined as a highly efficient instructional program emerged. Again, the three staff members tested each unit with students from each of the three groups. The new materials and performance tests enabled a more detailed analysis of student behaviors and achievement. Most of the information collected seemed to indicate that the only revisions and modifications required were in areas related to course organization and management.

Technical problems and errors were readily identified and performance items which were causing problems or difficulty were easily pinpointed. The instructors were most efficient in identifying students who were reasonably safe on performance evaluations without prerequisite learning activities and instruction. Such factors, coupled with the improved highly structured learning units, resulted in few recorded failures on items included within the instructor checklists. Because of the need for test subjects, most students were not allowed to use prerequisite resource learning materials other than the Project ABLE learning units. While this is not the way one would operate a flexible program of individualized instruction, it did result in a low rate of failure on specific checklist performance items.

An important part of the revisions incorporated as a part of the second phase testing, were the modifications adapted as a result of an analysis of the grade reading level. The "Fog Index" formula was applied to each unit. This process incorporates the following steps:

1. Pick out representative section of 100 words.
2. Count number of words in section sentences. (Skip proper nouns.)
3. Add numbers and divide by number of sentences.
4. Count number of words of 3 syllables or more. (Gives percentage.)
5. Total 3 and 4 and multiply by .4.
6. Answer is Fog Index or Reading Level.[78]

The analysis found considerable variation of reading levels within units and among units. Typically, the first page which included several paragraphs of information including the overview, tended to rank at a higher grade level than the steps included within the body of the units. The technical terminology required by certain units caused some variation among units. The present set of materials range between grade six and grade nine in reading level.

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[78]Robert Dunning, Technique of Clear Writing, (New York: McGraw-Hill, Rev. Ed. 1968).

During the second phase testing period, the U. S. Office of Education sponsored a review and evaluation of Project activity. A panel of eminent educators visited the site and examined the materials. Their report briefly commented on the progress in the Power Mechanics area:

> Instructional materials are very well written, strong on theory, testing and records. Shop organization is excellent and tool kits are provided for each job to be done. Students use teaching machines and mock-ups in learning the subject content.
>
> Some of the jobs require too much reading prior to doing a simple task. Evaluation of student retention appears to be weak, and some of the operations or jobs would be better taught in a work-experience program.[79]

These and other suggestions from the evaluation report have received careful consideration during the revisions and modifications following the second test phase. It should be noted that some of the criticisms were corrected by altering the method of implementation. Because of the small population of test subjects, many of the Power Mechanics students were involved in tryout activities which would not have been appropriate to a fully operational program of individualized instruction.

Planned as a part of the second test phase, was a comparison of the tenth grade ABLE students to the eleventh grade control group students on performance items. Toward

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[79]U. S. Office of Education, "Report of the Review Panel, Project ABLE," June 2, 1969.

the end of the school year, an initial attempt was made but terminated because of time factors. The eleventh grade students required a degree of instructor assistance and supervision which would have consumed more staff time than was available. Those few eleventh graders tested had considerable difficulty locating required specifications and information from the manuals and catalogs. They were unable to progress through units or to pass instructor checkpoints without retracing steps to correct errors in procedure and safety.

An alternative method of comparing the two groups was employed. A paper and pencil test, incorporating questions from the performance examinations was assembled. Items were chosen which appeared appropriate and representative of the behaviors specified.

The test was administered in June near the end of the school year. A total of 120 questions was included. The results were as follows:

Juniors (Control)	Sophomores (ABLE)	
$N_1 = 8$	$N_2 = 16$	N = number M = mean
$M_1 = 75$	$M_2 = 86$	R = range df = degrees of freedom
$R_1 = 58$ to 86	$R_2 = 67$ to 106	P = probability level t = value in distribution table by Fisher

A difference between means test yielded the following information:

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\Sigma x^2 + \Sigma y^2}{N_1 + N_2 - 2} \quad \frac{N_1 + N_2}{N_1 N_2}}}$$

$t = 5.29$

$df = 22$

$P < .001$

The probability is quite remote that the differences between the means were due to chance.

It should be noted that the activities and test items of the first level ABLE program must be considered as very basic to any course, traditional or otherwise, in auto mechanics and related areas. The eleventh grade (control) students would have been expected to have had considerable experience and practice in that area.

The techniques reported were considered practical and functional for the initial stages of pilot development. However, a more adequate program of validation and testing was recommended. A larger test population in varied geographic areas was planned as the next logical step. While the results from such a small population may not be generalizable to any great extent (and subject to question in terms of reliability and validity), it was the opinion of the staff that the course was functioning as intended.

United States Office of Education

In addition to the continuous internal testing and assessment of ABLE components, the project staff felt the need for an impartial assessment of materials. Accordingly, the U. S. Office of Education was contacted and agreed to assemble a panel of nationally recognized vocational educators for the purpose of assessing Project ABLE. The evaluation was delivered to the U. S. Office of Education and to the ABLE staff on June 4, 1969, by Professor Melvin L. Barlow, Review Panel Director. The following paragraphs describe the panels findings for the ABLE components.

> The Quincy School District is a dynamic educational system which administers a variety of innovative, experimental, and action projects, supported in part by Federal funds. It is quite evident that such projects have had in fact a beneficial effect upon redirecting the educational endeavors of the District. The "grantsmanship" ability of the District is well developed. The school system appears to be dedicated to providing a better educational break for a larger number of students and its functional and dynamic orientation has the support of the administration, the approval of the School Committee and the active interests of a majority of the instructors.
>
> Project ABLE became operational with the school year 1967-68. During the school year 1968-69, the number of students enrolled in the vocational program of Project ABLE was 109, the number of students in the academic program of Project ABLE was 37.
>
> Instructional materials for the academic program were developed with the assistance of personnel from the American Institutes for Research (AIR), based largely in Pittsburgh, and with the assistance of a selected group of teachers in the Quincy Public Schools.
>
> Instructional materials for the vocational-technical program were developed in the ABLE staff office (Quincy) with the assistance of AIR personnel and selected instructors from the vocational school program.

The guidance program was developed by AIR and provides for a systematic progression of guidance activities throughout the seventh, eighth and ninth grades. In each grade, activities are provided for self-evaluation, evaluation of the world of work, and matching self-characteristics with educational and occupational opportunities. Student workbooks are supplemented with a variety of films, film strips, and other audio-visual materials. In addition, a Counselor Guideline, for the entire junior high school program, has been prepared. This part of Project ABLE appears to be complete and functional, and is used as an integral part of the activities of the junior high school program.

In Science, the Project has produced materials adequate in quantity and extent, although not completely adequate in quality, range and variety, for the tenth and eleventh grades, mostly in biology.

In Mathematics, the individualized semi-programmed instructional units are available in sufficient quantity to provide a reasonably well sequenced approach to the subject. The program provides for self-pacing and allows for individual achievement. (Actually, all of the ABLE materials provide for self-pacing.)

Social Studies materials exhibit a high degree of creativity and purpose, and include some of the modern approaches to learning subject matter. The approach to the teaching of history was particularly unique. Despite the general quality of the material, a greater variety of presentation is needed including simpler directions and more learning steps.

In English, the motivation for reading appeared to be good. Students supported their English program by each contributing 10 cents per week toward the purchase of paperbacks for class reading. Students were reading more and enjoying it, and there were evidences of ingenuity in relation to the program. Students thought they were better able to comprehend and analyze what they were reading, but no specific data were offered to support this point.

The Electronic courses appear to be well planned and the students are apparently interested. The instructional content is good for basic training of electronic technicians, feedback items appear to be very good and the laboratory arrangement is satisfactory. Instructors like the system and are enthusiastically committed to it. The program provides for individual work, keeps the students busy, and it is possible to certify student's performance to prospective employers in terms of specific competencies achieved in training.

In General Woods, good organization is shown in the program and the materials which have been developed appear to be most satisfactory. However, not enough materials and projects are available to enable the student to progress at his own pace. The instructional content is based on a thorough analysis of the occupation.

Power Mechanics instructional materials are very well written, strong on theory, testing and records. Shop organization is excellent and tool kits are provided for each job to be done. Students use teaching machines and mock-ups in learning the subject content.

The Review Panel recommends unanimously the following courses of action:

1. That Project ABLE continue to its normal conclusion at its terminal date in 1970, however, funding for the year 1969-70 should be increased beyond the scheduled amount of $50,000, to an amount not to exceed $150,000, in order to provide for a proper closing-out of the project.

2. That the Quincy School District initiate a new proposal, for a period not to exceed three years, in order to demonstrate fully an integrated academic and vocational education program, and to report the success of initial placement and follow-up histories of the vocational-technical graduates.[80]

Because of the assessment report of Project ABLE's development efforts by the U. S. Office of Education Review

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[80] Ibid.

Panel, the writer was able to take action to strengthen several of the components. In addition, ABLE quickly moved into a new phase of operation, that of exporting ABLE products to the national community of vocational educators. Chapter VII details the impact of ABLE.

CHAPTER VII

THE IMPACT OF ABLE, CONCLUSIONS AND RECOMMENDATIONS

Local Effect

Over a period of several years, pilot programs emerged from Project ABLE. A number of curricula were prepared and implemented. Over 6,600 pages of curriculum materials and 1,000 pages of reference materials were developed for testing with Quincy students.

Two major products were prepared as a result of the research efforts in the Guidance area--the Occupational Analyses and the Student Vocational Plans. Occupational Analyses for each of the eleven job families, and one for the professions, were prepared. As reference materials for student use, such documents provided a description of the characteristics and requirements of occupations which were included within each job family. Each analysis includes a brief description of the occupation and some of the tasks involved: Listings of related and lower level jobs, where applicable, and placement opportunities; indications of the expected employment outlook, hours worked per week, and average earnings; information concerning the high school course of study, educational and training requirements, work conditions and physical demands of the job; relation to data, people, and things; personal interests, aptitudes, and temperament compatible with the occupation. The analyses for each family are arranged according to occupational areas.

The second major product is the Student Vocational Plans for grades seven, eight, and nine. (Each booklet is about 50 pages in length.) A primary objective of the vocational guidance plan is to have students participate in activities which require self-evaluation, investigation of the world of work, and matching credentials with available educational and vocational opportunities. For each of the three major areas, a number of activities were delineated for each grade.

The junior high program was implemented with over 4,000 Quincy students in grades 7, 8 and 9. The effort was seen as a limited objective program with the focus on career decision making.

In the electronics area, the first phase of development for the third level occupations in two areas has been completed. Thus, advanced study is now offered in Radio-TV repairman occupations. Furthermore, students qualified for the more difficult tasks may elect a third level technician program which covers a broad spectrum of jobs at a rather high level in the job family hierarchy.

The ABLE program now services all students in the electronics department. Class size averages between 12 and 18 students. Four classes are serviced at the 10th grade, two at the 11th grade and two at the 12th grade. The grade levels are roughly equivalent to job levels. However, students completing the basic tasks at a particular job level in a continuous progress program are permitted to advance immediately to the next training level.

The first two job levels have been through two complete test/revise/retest cycles. "Learner Activity Guides and Performance Evaluation Sets" and ABLE developed programmed instructional materials are available at both levels. Instructional materials at the second level include adaptations of the Lowry Air Force Electronics Mechanics package. The two third level programs have both Learner Activity Guides and Performance Evaluations available. However, Performance Evaluation testing and revision has not been completed. Nevertheless, the programs are operational and function as individualized instructional programs. Over 1,500 pages of instructional materials have been prepared for the four job training areas.

The Power Mechanics curriculum was tested with an end-of-course comparison between the 10th grade ABLE students (completing the first entry level program) and the advanced students enrolled at the 11th grade in a traditional program. The comparisons were made on basic job tasks and knowledge. The ABLE students were superior on job task practice and knowledge and were also better able to use automotive technical reference materials, lubrication guides, and catalogues. The management and evaluation procedures were developed and tested in pilot programs (such as Power Mechanics) as was the teacher training program.

As a part of the process of development, new grading and student assessment methods were applied. The specification of behavioral or observable performance objectives enabled important deviations from traditional grading and student evaluation procedures. A sample progress and certification reporting card or record is included, see Table 4. With such functional reporting methods (a condensation of information from the Criterion Checklist--Appendix J) little practical value would be gained by a continuation of traditional letter grades (i.e. A, B, C, D, F). Note that the reporting method does allow for an exercise of the instructor's expert judgment, task-by-task, through the L-M-S ranking. Note also that failures are <u>not</u> recordable. The student is certified on only those tasks in which a minimum level of competency can be demonstrated. In a sense, there are no failures. Some students will simply take longer than others to reach the various criterion levels task-by-task and job-by-job within the occupational hierarchy.

The progress board shown in Table 5, as an information feedback mechanism, can provide the type of guidance presently included in many of the available computer support programs. This is a low-cost student-operated mechanical system which will offer interim relief to the inordinately high costs of present day computer systems. Furthermore, the information is available at a glance at all times. Student location and the job task he is practicing is always identified. As indicated, red tags show location (absent, office, nurse, etc.) or task being performed by each student. Green tags indicate completion of performance evaluation and task certification. Yellow tags show that instruction has taken place and been completed on any one module or job task. Students applying the performance evaluation as a pre-test in order to certify competency and bypass instructional activity will have only green tags on such tasks. Masking tape under each tag provides a written record should the tags become scrambled. Again, each student maintains his own tracking and progress recording. Of course, the instructor keeps his own grade-book record as Criterion Checklists are completed. A quick glance will reveal work completed, options remaining, and rate of progress.

The approach has had interesting effects on student motivation. The implementation of the tracking system (along with other system modifications) resulted in a nearly 50% increase in student productivity--more work accomplished in a shorter period of time with a marked reduction in recorded discipline cases. The teacher was freed of unnecessary clerical chores which enabled an increase in tutorial interactions with individual students. Teacher anxiety was reduced with the better managed instructional environment. Graduation into the next higher job level became a visible fact and an accomplishable goal. Such a graphic presentation of individual progress in a flexible program of learner-centered instruction has had a marked effect on students, teachers and visitors.

A sample module is included in Appendix K. The basic module includes the Learner Activity Guide and Performance Evaluation Set.

As with the Power Mechanics curriculum, development of the Woodworking curriculum included learner activity devices, the Occupational Readiness Record and a student tracking system. Other important documents developed were: A frequency chart of job skills, a chart of developmental activity by sub-families and the three year general woodworking program chart. Also derived were the job titles, general woodworking occupational analyses, all performance objectives by job family clusters, the performance objectives for the basic woodworking core program, a sample Learner Activity Guide and Performance Evaluation Set, a list of times required to complete learning and performance assessment activities, and recommended tools, supplies, equipment, and training aids.

A comparison of ABLE "woods" students for the 1969-1970 school year to those students enrolled at the same level during the previous year, found the number of job tasks and behavioral objectives accomplished more than double that of the previous year. Furthermore, discipline problems handled and recorded dropped from 35 to 5. Other interesting comparisons were noted, such as the advance registration figures for the 1970-1971 school year which indicate an 85% increase in enrollment in the ABLE basic woods course. This compares to an overall rate of increase in enrollment of 45% for the vocational school across all job family areas.

Major features of each of the ABLE academic classrooms, in addition to the methods of individualized instruction, are the "decentralized resource centers." In an attempt to increase student motivation, improve program effectiveness and relevancy, and bring about a closer relationship between the academic program and the vocational areas, numerous resource materials and alternative texts (alternative to the highly structured core type materials developed by ABLE) have been placed in the classrooms. The obvious emphasis here is on flexibility and accessibility to many materials appropriate to vocational related studies.

To further improve on the critical integration of vocational and academic studies, the academic teachers had been given release time to visit shops, develop their resource areas, and to improve their instructional materials. Furthermore, Quincy is attempting to acquire the capability to prescribe for each individual, his learning requirements and activity. An increased computer capability, the availability of behavioral objectives for the vocational and academic areas, and the accumulated data on each student from the time he enters school may well spell "breakthrough" in what now is described as a major concern -- the effective and appropriate integration of academic and vocational studies. Plans have been presented and approved to utilize the ABLE materials in various ways with 400 Mathematics students and some 900 English students. (See Appendix L.) Many of the students in the Social Studies and Science departments are using some form of ABLE materials.

National Effect

Correspondence and documents related to the field testing of ABLE curriculum materials among several Great City and ES'70 network schools (Power Mechanics initiated during the 1969-1970 school year and General Woodworking during the 1970-1971 school year) are provided. (See Appendix M.) In short, the pilot instructional systems have been in operation since completion of the USOE contract. Furthermore, the school systems testing the ABLE instructional systems have adopted the procedures, the management and evaluation plan, and the process for continued development. More important, the project has been considered for massive implementation by a consortium of the twenty-one largest school systems in the country. (See Appendix N.)

The technology applied on a limited scale with considerable success by Project ABLE is said to be of national significance. For example, Dr. Robert M. Gagné (presently president of AERA) found the rationale, training materials and testing procedures of remarkable and unusual excellence. He stated, "I should think the acceptance of this method by teachers and students would be well-night universal." Dr. William T. Kelly, Director of Vocational Education in Philadelphia, wrote that, "It is imperative that some method be found to reproduce this material at a cost within the reach of school districts." Dr. Karl F. Dutt, Research Coordinator for the Eastern Northampton County Schools in Pennsylvania, considered the approach to be an "ideal learning experience." Dr. John M. Recklitis, Director of Vocational Education for the Penn Hills School District in Pittsburgh, found one ABLE program to be, "second to none in the nation." Dr. William L. Hull, Research Specialist at the Ohio State Center for Research and Leadership Development in Vocational and Technical Education stated, "This project (ABLE) may be one of the few in the nation which provides a <u>living example</u> of an innovative diffusion system in action at the local level."

One of the more important outcomes of Project ABLE is the hundreds of behavioral objectives which have been prepared in the vocational areas. Complete sets have been released to the Research Coordinating Unit (RCU) of Massachusetts and the Instructional Objectives Exchange at the University of California, Los Angeles (UCLA). The objectives are keyed to tasks which in turn are ranked on a hierarchy of job skills and levels. More important, the objectives are generalizable to several hundred occupations which were clustered by job families.

While the early efforts at teacher training were inadequate and a factor in the early problems of the project, the subsequent establishment of operational demonstration programs resulted in a teacher training program of some significance, locally and nationally. ABLE developed and then conducted during the month of February 1970, an instructor training program. The first trainees were from the Baltimore and Philadelphia school systems. The purpose of the training was to insure proper implementation, operation and evaluation of field test activities for the power mechanics instructional system. The instructor training program was designed as a "hands-on," individualized, self-paced experience. The trainees (after receiving a brief overview of project programs, techniques, processes, etc.) entered the power mechanics course playing the role of novice students. They were required to successfully perform as students in the accomplishment of learning materials, performance evaluation modules, and operation of the system components. This included use of the research instruments and information forms which the instructor would ultimately administer. Proper operation of the student tracking system and the various training aids were included. Of course, the trainees were evaluated against program criteria by experienced staff.

The instructor-trainees were then placed in the role of course instructors and allowed to practice that job under live conditions. This included the administration of various research instruments intended for validation purposes during the field test activities. The trainees were also evaluated in their activities against the Instructor Performance Checklist. Here, three levels of certification were again required. (A supervisor from each of the field test schools received the same training.) Additional practice was structured as an in-service program in which the course modules would be operationalized and implemented one at a time, at the test site. Precise procedures were specified which enabled a standardized replicable process to be followed in the implementation and testing of course materials module by module. Supplementary documents and optional reading materials were provided each trainee along with optional "enrichment" resources (theory and philosophy related to individualized instruction, systems development, behavioral sciences, etc.). Such training was accomplished in less than three days. More important, the same process would be replicable at each of the field test sites should general dissemination be undertaken.

Conclusions

Several conclusions can be drawn from the information documented in this study. They are:

Many of the instructional development processes used in public education today derived from the military.

Instructional system processes developed by the military can be effectively utilized for the development of vocational instructional systems.

Cooperation between the U. S. Office of Education, the Quincy Public School System and the American Institutes for Research, has resulted in the production of vocational curriculum using the military model.

Project ABLE instructional systems development processes and products have had an impact locally and nationally, in the field of vocational education.

Recommendations

Vocational and technical education is facing a critical need for instructional systems development such as that characterized within the original goals of Project ABLE and groups such as the Council of the Great Cities Schools and ES'70. However, progress across the nation in the development of instructional systems for vocational and technical education has been disappointing. Several vocational directors of large city school systems have cited curricula and curriculum development as their major problem area. It is, therefore, recommended that the following tasks be undertaken:

1. Instructional systems (of the ABLE design) for the larger job families should be developed, implemented, field tested, and nationally disseminated. This development should take place in the school systems of our metropolitan areas through a coordinated and cooperative effort.

2. The application of effective management and evaluation techniques (again of the ABLE design) should be undertaken in the urban cities of this country as an integral part of instructional systems development and operation.

The need for the accomplishment of these tasks is well documented and, of course, accomplishment of each of the tasks is dependent on one another. Naturally, the process must be financially desirable. The process must also result in early operational instructional programs. Indeed, the President, Congress, the profession, and the populace are demanding immediate visible evidence of quality educational products and programs. Accountability features through performance contracting must be a key factor. Assessment of project, programs, products, teachers and students must be an integral part of the process and the emphasis in assessment must be on continuing program improvement -- a truly regenerative process with corrective feedback mechanisms.

Related to Tasks 1 and 2 is the need to accomplish field testing and dissemination of instructional systems developed by Project ABLE. Some of these programs are in Power Mechanics, Woodworking and Electronics. Since only portions of the three job families have been developed, the advanced levels should be completed. More important, with respect to the needs of the major metropolitan areas, is the same kind of development in many other job family areas, which should be undertaken immediately in each of the partner school systems -- development which could, in turn, be field tested by participating members. The outcome of such activity would include the establishment of fully operational exemplary demonstration programs. Such demonstration areas should then become centers for the training of curriculum developers and teachers, and the focal point for national dissemination. This may be the only functional way of training curriculum R&D staff. And, this is likely the only way relevant teacher-training programs can be conducted -- hands-on, under live conditions, through the kind of procedures advocated for the students (including use of performance standards and learner-centered individualized instruction). Obviously such exemplary demonstration programs would serve many functions, as do the existing ABLE instructional systems.

No individual school system, sponsor, agency, industrial or private developer, or research organization could possibly accomplish all of the defined tasks. It is also unlikely that any one school system in cooperation with a research organization (such as the original ABLE operation) could make any sizable contribution of national significance to the curriculum needs in vocational education. The problem in the area of learner-centered vocational curriculum development is simple to define -- inadequate resources. This would include the lack of a systematic application and concentration of available funds, and the inefficient use of available trained staff.

Furthermore, on a small and limited basis, the current method of curriculum development (teachers writing for personal classroom use) is not practical because of the lack of assessment, uneven quality and questionable benefits from the high development cost. We can now accept the fact that a rather high level of funding is necessary for developing instructional systems. Such a level of funding can be justified only if the materials and systems can be used widely. Such replicability requires a high degree of quality control in the developmental process. Quality control cannot occur without proper and effective management and evaluation procedures. This is not possible without the direction of highly structured performance-accountability type contracts. Such contracts require experienced and competent research and management personnel to structure and implement the contracts. Effective policy direction is necessary, and expert technical advisors of national stature are needed to monitor development and implementation. In short, the developmental effort must focus on system design analysis, management by objectives, technology of instruction, quality assurance and performance, and accountability contracting.

A proposed solution to these problems of vocational instructional systems development, is reasonable and practical. The plan is based on the high probability that a cooperative approach by several large school systems with effective research support and management assistance would be able to gather the financial resources (Federal, State, local, industrial) to accomplish the tasks. From this base, each school system would sponsor (i.e. with the kinds of funding now available as a result of changes in recent Federal legislation) independent development in one or more specific job family areas. This would also enable a concentration of resources within each city and reduce the duplicated effort now taking place within and among such school systems. For example, one city could reduce its usual curriculum development efforts in job family X (since one of the field test participants or one of the other metropolitan systems would be concentrating resources in that area) and divert its resources to work in area Y. Widespread use, relevancy and applicability in the other cooperating schools, and on a state and national scale as field testing progresses, would be assured through the highly structured management procedures. This would be accomplished by the effective direction of a policy group of one of the major educational consortiums.

It would be necessary for each participating school system to establish exemplary demonstration centers for local, state and national dissemination for the job family under development. This would also be the center for the training of instructors and curriculum development support personnel. More important, the investment (through reciprocal activity in the other partner systems) would result in the early establishment of additional demonstration centers for other job family areas. This is a kind of "pay for one and get a dozen" bargain, and such proliferation of quality instructional systems at the "grass roots" level is a highly desirable outcome. Again, it is only through centralized coordination and quality control procedures with a number of locally initiated and support developmental units, that the desired results and products would be guaranteed. Actually, the development would be in a way decentralized, in order to gain access to the student target population during the critical initial develop/test/revise/retest cycles of instructional systems development process.

In summary, the major advantages of this proposed plan include the ability to:

1. Spread costs among agencies, governmental levels, states, cities, and schools.

2. Concentrate resources from several geographical areas.

3. Eliminate redundant activity and thus realize needed economies.

4. Insure centralized quality control.

5. Develop disseminable products and replicable instructional systems.

6. Provide many schools, through the dissemination of quality products, the means for dispensing with irrelevant and inappropriate curriculum development.

The proposal is presented with the following assumptions:

1. Various states are interested in developing, demonstrating, and testing, within their states, innovative programs of the type being evolved through ABLE research.

2. Funding for such programs may be obtained from the respective state departments of education in the states of the Great City Schools.

3. Included in the undertaking would be representatives from the following organizations:

   a. State Department of Education, Trade and Industrial Education Division.

b. A majority of the member systems of the Great City Schools and school systems within the local area at the dissemination stage.

c. A nearby teacher education institution interested and involved in similar activities to provide in-service training in individualized instruction to project participants.

APPENDIX A

DEFINITION OF TERMS (ABLE)

<u>Adjunctive Program</u>: A structured document which makes use of existing materials (programmed or non-programmed) as the primary source of instruction, around which a programmed guide (objectives, questions, etc.) is built to direct the student through the learning experiences.

<u>Affective Domain</u>: Deals with emotions or feelings. Described by words such as interest, appreciation, enthusiasm, motivation and attitude.

<u>Behavioral Analysis</u>: See Task Analysis.

<u>Behavioral Objective</u>: A behavioral objective is similar to a performance objective with the two seldom being differentiated. However, the connotation implies a clinical analysis of covert and overt behaviors, with a charting of the S-R units after the task description has been completed.

<u>Cognitive Domain</u>: Deals with thought processes. Described by such words as knowledge or understanding.

<u>Content Analysis</u>: Identification of instructional objectives by analyzing texts and other existing instructional materials.

<u>Criterion Checklist</u>: The portion of a performance evaluation set where an instructor records either a satisfactory or unsatisfactory rating of the student's achievement of subobjectives which may include the critical incidents of the job task.

<u>Criterion Referenced Test Instrument</u>: An evaluation instrument which measures a student's achievement against stated objectives rather than comparing one student to another or to a test group.

<u>Critical Incident</u>: Specific behavior found to be critical to performance success. Can be described as an activity or action which was either very effective or very ineffective. A decisive incident.

<u>Diagnosis</u>: The process of obtaining and analyzing data about the learner for purposes of appropriate individualized learning requirements.

<u>Feasibility Study</u>: A study conducted for the purpose of determining whether or not the instructional system development process should be applied to a course of instruction. Factors such as course prerequisites, investment requirements, employment opportunities and numbers of students to be trained are taken into consideration.

<u>Feedback</u>: The function of a device which provides "knowledge of results" to the student curriculum developers, project manager and others.

<u>Formative Evaluation</u>: A kind of process research or outcome evaluation at an early or intermediate stage of activity for the purpose of discovering deficiencies and successes in the development. In education, such a process is used primarily to improve materials or a

course rather than to appraise products or to compare methods and materials.

Hands-On: Activity in which the trainee "handles" the tools, equipment or materials required for job task performance. Simulation possible where appropriate. Activity oriented learning or laboratory work in contrast to lectures, textbook reading assignments, etc.

Individualized Instruction: Instruction which is learner-centered rather than instructor-centered. Students engaged in individualized instruction activities can be observed to be performing significantly different than students in a traditional course of instruction. Choosing the task to be mastered, charting work progress, obtaining examination results and mastering tasks at an individual rate are student activities which can be clearly observed to be different from student behaviors in traditional courses. The right of every individual to acquire an education within the school system in his own way and at his own rate of learning.

Interactive Evaluation: An evaluation process which is repeated time after time (i.e. test/revise/retest cycles) to assure accuracy, quality and relevancy of the training materials and program.

Job Cluster: A group of jobs within a particular job family.

Job Family: A group of jobs which have a common core of tasks and tools and use similar raw materials.

Learner Activity Devices: Training aids or equipment which provide the student with the hands-on activity required for objective mastery.

Performance Objective: A stated goal of task mastery. The statement is in reference to overt behavior (observable and measurable) and specifies the quality standards of the performance and conditions of the situation. The goal is usually derived from a task description. There are a number of methods of acquiring a description of the tasks being performed by trained personnel in the field.

PERT: Performance evaluation and review techniques often used with CPS -- critical path scheduling -- for purposes of management control. A system for planning, scheduling and controlling a project. Provides a means of control by constant assessment of actual performance and progress against planned activities.

Project ABLE: Development and Evaluation of an Experimental Curriculum for the New Quincy Vocational-Technical School.

Psychomotor Domain: Deals with muscular movement. Described by such words as adjusts, turns, screws, etc.

Regenerative: To reform, to reproduce, to renew, to restore, (etc.) through follow-up evaluation activities oriented toward program improvement. In vocational-technical education, evaluation systems must be especially sensitive to changes in the technology, equipment, practices and procedures, etc.

Self-Scoring Response Device: Any paper-pencil or machine devide which provides a student with immediate "knowledge of results" on questions which he has answered. Can be used in hands-on situations to confirm mastery of tasks accomplished.

Summative Evaluation: An evaluation process which amasses statistical information which, in one example, is used to make comparisons among products or methodologies. Experimental-control groups are usually structured for testing purposes.

Systems Approach: A management process which is focused on system design analysis, management by objectives, technology of instruction, quality assurance and performance, and accountability contracting. The specification of events, processes, outputs, etc., with information feedback mechanisms for constant monitoring and adjustments.

System Control Documents: Evaluation instruments and detailed checklists of tasks required of personnel involved in the instructional system development process. Provides for quantity and quality control of work being performed at the various levels within the developmental process.

System Development Team: The technical writers, behavioral psychologists, subject matter specialists, editors and project managers engaged in a coordinated team effort utilizing the instructional system development process.

Task Analysis: An analysis of the behavioral implications of the task description, through a clinical process which requires ". . . all that is known and much that is conjectured in the full area of experimental psychology." This implies an analysis of overt and covert behaviors with a charting of S-R units. It is said to be a heuristic description of activities which invites much randomness.

Task Description: A complete description of specific interactions between man and machine. It is said that a good task description could be used as a procedural manual for the novice. It should enumerate all the circumstances in the stimuli and responses that can occur. Task descriptions can be derived from a content analysis, by simulation, by interview (consensus) analysis, or by observation (identification of S-R units).

Test/Revise/Retest Cycle: That portion of the instructional system development process where individual performance evaluation and learning activity materials are systematically tested, revised and retested prior to implementation in the classroom or laboratory.

<u>Validation</u>: To confirm or prove. Usually accomplished through field testing with a population of adequate size to insure generalizability. Proof of doing that which was intended, as measured against specific criteria and quality standards.

<u>Verification</u>: To test or check accuracy or exactness. While the meaning is similar to the definition provided for <u>validation</u>, the connotation in education implies a less rigorous process with a population inadequate in size to claim validation.

APPENDIX B

ABLE PROPOSAL

AN EXPERIMENTAL PROGRAM

Submitted to the U. S. Commissioner of Education
Under the Provisions of Section 4(c) of
the Vocational Education Act of 1963

Project Title	DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL	
Applicant	Quincy Public Schools and Coddington Street Quincy, Massachusetts, 02169 Tel: (617) 471-0100	American Institutes for Research 410 Amberson Avenue Pittsburgh, Pennsylvania, 15232 Tel: (412) 681-3000
Initiated by	Maurice J. Daly Asst.Supt. for Vocational-Technical Education Quincy Public Schools Coddington Street Quincy, Massachusetts, 02169 Tel: (617) 471-0100	Robert M. Gagné Director of Research American Institutes for Research 410 Amberson Avenue Pittsburgh, Pennsylvania, 15232 Tel: (412) 681-3000
Principal Investigator	Robert M. Gagné American Institutes for Research	
Submitted by	Robert E. Pruitt Superintendent Quincy Public Schools	John C. Flanagan President American Institutes for Research
Federal Funds Requested	$623,550	
Duration	Beginning 1 January 1965 Ending 31 December 1969 Total number of months required: 60 months	
Date Transmitted	6 November 1964	

ABSTRACT: Project ABLE

USOE Project No. 5-0009
Contract No. OE-5-85-019

A Joint Research Project of: Public Schools of Quincy, Massachusetts and American Institutes for Research

Title: DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

Objectives: The principal goal of the project is to demonstrate increased effectiveness of instruction whose content is explicitly derived from analysis of desired behavior after graduation and which, in addition, attempts to apply newly developed educational technology to the design, conduct, and evaluation of vocational education. Included in this new technology are methods of defining educational objectives, deriving topical content for courses, preparation of students in prerequisite knowledges and attitudes, individualizing instruction, measuring student achievement, and establishing a system for evaluating program results in terms of outcomes following graduation.

Procedure: The procedure begins with the collection of vocational information for representative jobs in eleven different vocational areas. Analysis will then be made of the performances required for job execution, resulting in descriptions of essential classes of performance which need to be learned. On the basis of this information, a panel of educational and vocational scholars will develop recommended objectives for a vocational curriculum which incorporates the goals of (1) vocational competence; (2) responsible citizenship; and (3) individual self-fulfillment. A curriculum will then be designed in topic form to provide for comprehensiveness and also flexibility of coverage for each of the vocational areas. Guidance programs and prerequisite instruction to prepare junior high students will also be designed. Selection of instructional materials, methods, and aids, and design of materials, when required, will also be undertaken. An important step will be the development of performance measures tied to the objectives of instruction. Methods of instruction will be devised to make possible individualized student progression and selection of alternative programs, and teacher-training materials will be developed to accomplish inservice teacher education of Quincy School personnel. A plan will be developed for conducting program evaluation not only in terms of end-of-year examinations, but also in terms of continuing follow-up of outcomes after graduation.

APPENDIX C

CONTRACT AWARD LETTER

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF EDUCATION
WASHINGTON, D.C. 20202

Contract Number
OE-5-85-019

[illegible]

Dr. John C. Flanagan
President
American Institutes for Research
410 Amberson Avenue
Pittsburgh, Pennsylvania 15232

Dear Dr. Flanagan:

We are pleased to enter into a letter contract with your institution under the provisions of P.L. 81-152, Title III, Sec. 302(c) 15; Subpart A, Section 4(c) of P.L. 88-210, (Vocational Education Act of 1963), 77 Stat. 405 for "Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School."

, under the direction of Dr. James W. Altman , in accordance with your attached proposal. You are authorized to begin work on the project effective April 1, 1965 , and to spend up to but not exceeding $16,000 for salaries, wages, benefits, supplies and materials, services, travel, per diem and consultant services.

Mr. Michael Russo, Project Officer, and John P.L. Thornley, Contracts and Grants Officer, will work with you and your staff to complete the negotiation of a mutually acceptable Plan of Operation. Upon completion of the negotiations, a Cost-Reimbursement Contract will be sent to your institution for signature. The contract period will be from April 1, 1965 to June 30, 1966.

After the effective date of this letter contract and until a definitive contract is negotiated, the parties shall be governed by the terms and conditions set forth in the attached instruments. These instruments include the Special Provisions which appear in the standard definitive cost-reimbursement contract used by the office of Education in contracting for Research in Vocational and Technical Education, and the applicable General Provisions.

In the event that this letter contract is not superseded by a definitive contract, the Contractor shall be compensated in accordance with Article 17 of the attached General Provisions, but not to exceed the amount reflected in paragraph one above.

This letter contract shall expire on June 1, 1965 , unless superseded by a definitive contract prior to such date. Until a contract has been negotiated, no public announcements or press releases should be issued.

We appreciate your cooperation and willingness to make the resources of your organization available for furthering Research in Vocational and Technical Education. If you agree to proceed with the project under the terms of this letter contract, please sign the enclosed copy on the line designated and return it no later than April 1, 1965.

Sincerely yours,

Francis Keppel

U.S. Commissioner of Education

Enclosures

ACCEPTED:

By ______________________

Title ______________________

Date ______________________

APPENDIX D

MINUTES OF A.I.R.-QUINCY MEETING, MAY 8, 1965

Internal Conference on Vocational Education

Research Project -- Quincy, Massachusetts

Time: 9:00 A.M. - 4:00 P.M., Saturday, May 8

Place: Dolphin Room, Sheraton Motor Inn, Quincy, Massachusetts

Moderator: Robert M. Gagné

Agenda: Discussion centered on such questions as the following, phrased as though addressed by A.I.R. people to Quincy people:

(1) We believe that the source for information relevant to objectives of vocational (or more generally, secondary) education must be derived from detailed accounts of what people do, in their jobs and otherwise. This is not a way of thinking about the question that is well-known to teachers, or for that matter, to many other people. What difficulties, if any, do you foresee in carrying out such an approach?

(2) Our tendency has been to emphasize the importance of (a) vocational, (b) citizenship (including family living), (c) self-fulfillment objectives pretty much in that order. We tend to believe that pursuing a work career satisfactorily is itself basic to good citizenship, as well as to the enjoyment of life. Other people, however, might argue for a different emphasis. Is our emphasis acceptable?

(3) We think the project should aim to select and organize the contents of the curriculum on the basis of evidence of needs, rather than on grounds of tradition or aesthetics. Specifically, we believe the mathematics taught should fill a need of the individual in terms of the goals stated in (2); similarly for social studies, English, or any other subject. We suspect (from our own experiences) that there may be topics or subtopics in today's curriculum that have exceedingly low utility. We are quite sure there are topics of high utility that are not included. If one pursued this approach he would no doubt end up with "subjects" that could be called "English," "mathematics," "social studies," etc., but they might have quite a different composition than the subjects presently so labeled. The same things can be said, essentially, for the more specific vocational subjects. Are there insuperable difficulties here for (a) college-preparatory subjects (considering the problem of college qualification); (b) general or core subjects; (c) vocational subjects?

(4) The proposal speaks of solving the problem of educating all students by "individualizing instruction." A number of schools have tried this, and there is a lot of current interest in it. Also, there are different ways to do it, some of which seem to be mostly eyewash. To accomplish this really, one has to permit students to go as far as they wish in self-instruction. This creates two problems. The first is materials, which must be available in differently sized "chunks" and in much

greater profusion than is usual. The second is the teachers' functions and procedures, which tend to be altered considerably. When such altered functions are fully accepted, it is often reported that teaching becomes more fun, and even takes on an added dimension of satisfaction. However, the point is, there must be a real and profound change in order for individualization to work. What do you think needs to be done to bring about such changes, particularly the latter one?

(5) There are questions about an evaluation procedure, which could perhaps be put off until later. Perhaps the most fundamental one is, how thoroughgoing a procedure do you want us to design to provide you with feedback about all your students after graduation?

(6) What are the important points to emphasize in briefing other people about the project?

APPENDIX E

MINUTES OF FIRST ABLE ADVISORY PANEL MEETING, JUNE 26, 1965

AMERICAN INSTITUTES FOR RESEARCH
410 Amberson Avenue
Pittsburgh, Pennsylvania 15232

Minutes of the Meeting of the
Advisory Panel for Project ABLE
Quincy, Massachusetts

June 26, 1965

Present: ADVISORY PANEL: Anne Donovan; Richard B. Ford; Norman C. Harris; Joseph T. Nerden; Erwin R. Steinberg.

QUINCY PUBLIC SCHOOLS: Lloyd M. Creighton; Maurice J. Daly; Robert E. Pruitt; John W. Walsh.

AMERICAN INSTITUTES FOR RESEARCH: Robert M. Gagné; Edward J. Morrison.

Absent Panel Members: Hamden L. Forkner; Gyorgy Kepes.

MINUTES

1. Background Information. Robert Pruitt summarized a variety of data relevant to the work of the Panel. The summary included an historical review of the city, its public education, and its social and economic characteristics. The development of the present program and plans for vocational-technical education, including the new school building and the new curriculum, also were reviewed. A chart summarizing the aims and methods of vocational-technical education in Quincy was discussed and copies were distributed to the conferees. Statistics and other findings from occupational surveys in Quincy were interpreted as showing that the primary saleable commodity in Quincy is the skill of its people in a variety of trades and technical occupations. Quincy residents travel in substantial numbers to the surrounding area to work, so that training in Quincy serves a broad geographical area. Provisions in Massachusetts for vocational education were reviewed, including those for adult training, for vocational retraining, and for attendance at public institutions apart from the student's residence community.

APPENDIX F

QUARTERLY TECHNICAL REPORT SUMMARIES

30 June 1965

DEVELOPMENT AND EVALUATION OF AN EXPERIMENTAL CURRICULUM FOR THE NEW QUINCY (MASS.) VOCATIONAL-TECHNICAL SCHOOL

FOREWORD

This report, submitted in compliance with Article 3 of the contract, summarizes the technical progress of Project ABLE during its first quarter of operation, 1 April to 30 June 1965. A brief overview of the project is presented first. Then, following in order, are a report summary, a short review of project organization and schedules, discussions of specific technical topics and, finally, plans for next quarter. A number of appendixes supply details relevant to topics covered in the body of the report.

REPORT SUMMARY

This report summarizes technical progress to 30 June 1965. Activity during this initial period has been concentrated in behavior analysis and guidance program development. Identification, selection, and description of jobs for inclusion in the training program has begun in nine vocational areas and significant progress has been achieved in five of the areas. The present Quincy guidance program has been described and guidance objectives to support the new curriculum are under development. In its first meeting 26 June, the Advisory Panel reviewed the aims, procedures, and expected outcomes of the project and agreed upon procedures for development of instructional objectives. It is expected that during the next quarterly period the behavior analysis will be substantially completed, analysis of requirements in mathematics and social studies will begin, instructional and guidance objectives will be prepared in first form for review by the Advisory Panel.

SECOND QUARTERLY TECHNICAL REPORT

30 September 1965

THE PROBLEM OF DEFINING OBJECTIVES

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its second quarter of operation, 1 July through 30 September 1965. A brief overview of the project is presented first, followed by a report summary which includes a short review of technical schedules. The major portion of the report is devoted to consideration of educational objectives and includes a discussion of criteria for objectives followed by sections on defining instructional objectives in Project ABLE and on objectives for the guidance program. Plans for next quarter are outlined.

REPORT SUMMARY

During the present reporting period, technical activity has been concentrated on development of project objectives for instruction and for the guidance program. The objectives sought are unambiguous statements of successful student performance which include the criteria of success and the important conditions under which the performance is to take place. Before such objectives can be selected, a logical structure must be developed through which specific objectives can be related to the broad educational goals of the curriculum. This report reviews criteria for objectives, describes the necessary logical structure, and illustrates its application in Project ABLE. In addition, the development of objectives for the guidance program is reviewed and related to the development of instructional objectives.

During the immediately preceding quarter, activity centered on vocational analysis and review of guidance program needs, work which was an essential preliminary to the development of objectives. During the next quarter, the Advisory Panel will review objectives so far developed, objectives will be revised and augmented, and derivation of topic objectives will begin.

31 December 1965

CURRICULUM IMPLICATIONS OF THE STUDY OF OBJECTIVES

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its third quarter of operation, 1 October through 31 December 1965. A brief overview of the project is presented first, followed by a report summary. The major sections of the report concern (a) the curriculum implied by the preceding study of objectives and (b) the development of topic objectives. Plans for next quarter are outlined.

REPORT SUMMARY

During the present reporting period, the principal technical activity has been the selection of a curriculum and the development of topic objectives within each course of study. In prior months, work on objectives emphasized the development of comprehensive maps of the total set of objectives applicable to a vocational-technical curriculum for Quincy. Once the domains of educational objectives were mapped, the task became one of selecting specific objectives for the curriculum from the very large number available. When the curriculum had been selected and planned, objectives for topics within the curriculum could be defined. This report summarizes the curriculum implications of our study of objectives, outlines a curriculum for the vocational-technical school, discusses the rationale of topic objectives and the procedures for deriving them, and reviews the major practical problems encountered.

During the next quarter, derivation of topic objectives will continue, development of instructional materials, methods, aids and procedures will begin, and detailed plans for the Junior High guidance program will be completed.

31 March 1966

A VOCATIONAL GUIDANCE PLAN FOR JUNIOR HIGH SCHOOL

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its fourth quarter of operation, 1 January through 31 March 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report is devoted to presentation of the vocational guidance plans for junior high school students. Project plans for next quarter are outlined.

REPORT SUMMARY

During the present reporting period, technical activity centered on the derivation of topic objectives for each course of study and on the completion of junior high school guidance program plans. Since the work in vocational analysis and in curriculum development, including the derivation of topic objectives, has been described in previous reports, the present report is devoted to the guidance program which has been developed concurrently with the other project activities. This report reviews the procedure being followed to develop the guidance program, summarizes the status of program development, identifies and discusses the principles employed to guide planning for the junior high program, and describes the junior high plan for achieving each objective of the guidance program.

During the next quarter, instructional materials, methods, aids, and procedures, as well as performance measures, will be under development. In addition, development of junior high materials to support the guidance program and guidance staff training will begin.

30 June 1966

THE ROLES, CHARACTERISTICS, AND DEVELOPMENT PROCEDURES FOR MEASURES OF INDIVIDUAL ACHIEVEMENT

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its fifth quarter of operation, 1 April through 30 June 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report is a discussion of the development of performance measures to be used to assess students' achievement of the objectives of instruction. Project plans for next quarter are outlined.

REPORT SUMMARY

During the present reporting period, technical activity was directed primarily to (1) continued development of junior high guidance program materials and completion of arrangements for program implementation, (2) completion of course and topic objectives in some curriculum areas, and (3) the beginning of development of measures for verifying students' achievement of instructional objectives. The present report is concerned with achievement measures. It reviews the curriculum structure and instructional methods which have been planned and identifies a number of important roles for which achievement measures are needed. The technical requirements for measures employed in those roles are examined and the procedures for developing such measures are discussed.

During the next quarter, test development will occupy a greater proportion of total activity. Selection and development of instructional materials, aids, and procedures will continue concurrent with the development of measures. Junior high guidance preparations will be completed and the program will be initiated.

30 September 1966

THE DEVELOPMENT OF LEARNING UNITS

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its sixth quarter of operation, 1 July through 30 September 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report is a discussion of the development of learning units by which students acquire the capabilities that are the objectives of instruction.

REPORT SUMMARY

During the present reporting period, technical activity concentrated on (1) completion of materials, staff training, and implementation arrangements for the junior high guidance program and start of the program in all junior high grades, (2) development of measures for assessing student achievement of instructional objectives, and (3) the design of learning units for the curriculum. The present report is devoted to the problems, procedures, and principles of developing learning units. It reviews the process whereby learning units necessary to the achievement of objectives are identified, describes the principles and methods for the design of learning units, and discusses some implications of the resulting curriculum for the teaching and administrative functions.

During the next quarter, the design of learning units and the related measures of achievement will constitute a major portion of the technical activity. In addition, procedures for evaluation of the junior high guidance program will be devised, development of senior high guidance objectives will continue, and the Advisory Panel will meet to review products and to consider the problems of implementing the program.

31 December 1966

THE SEQUENCING OF LEARNING UNITS

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its seventh quarter of operation, 1 October through 31 December 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report addresses the problem of selecting sequences for learning units so that students acquire the desired performance capabilities systematically and efficiently.

REPORT SUMMARY

During the present reporting period, technical activity emphasized (1) continued tryout of the junior high school guidance program and development of procedures and devices for its evaluation, (2) development of measures for assessing student achievement of instructional objectives, and (3) preparation of learning units. This report on the problems of designing effective sequences for learning provides a sequel to the preceding quarterly report on the design of learning units. Major sections of the report consider: the gross sequence established by general curriculum policies, the specific sequence requirements due to the structure of objectives, major factors affecting the efficiency of learning sequences, and empirical test and revision of the initial sequence design.

During the next quarter, the design and sequencing of learning units and the development of the accompanying achievement measures will absorb a major portion of project activity. In addition, the collection of data for evaluation of the junior high guidance program now in tryout will continue, development of senior high guidance program plans and materials will continue, and plans for teacher training will be outlined.

EIGHTH QUARTERLY TECHNICAL REPORT

March 1967

PROBLEMS RELATING TO THE DEVELOPMENT AND IMPLEMENTATION OF A VOCATIONAL CURRICULUM

ERIC Document Number ED 028 306

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its eighth quarter of operation, 1 April through 30 June 1966. A brief overview of the project is presented first, followed by a report summary. The major portion of the report is a discussion of the development of performance measures to be used to assess students' achievement of the objectives of instruction.

REPORT SUMMARY

This report describes the problems encountered while designing, developing, and implementing an experimental curriculum in a vocational-technical school. There are several dangers inherent in such a discussion because there is always a tendency to blame the inevitable inadequacies of the experimental program on the other fellow.

The failure to meet specific requirements of project development derives from a number of sources, some of which can be attributed to gaps or loop-holes in the proposed methodology and some of which are the result of the unexpected. When each step is satisfied according to the plan, the resulting product usually has a greater chance of being implemented effectively in a live school setting. However, any design that fails to leave room for adjusting to the unforeseen is lacking in itself. The realities of the implementation phase almost always reveal significant gaps in the design and development phases--the largest gap usually being the failure to prepare an adequate design for implementation.

The initial enthusiasm associated with involvement in an experimental curriculum must be maintained through the tedious work of development and implementation. When any part of the process is separated from the whole, the loss of perspective which develops results in actions which often negate or impede the forward movement of the effort. The "old" ways are always near, and may be retrieved to fill any gap appearing in the new design. Although this may be necessary at times, such fixes tend to be retained rather than serving as a temporary filler until the innovative step is formalized and tested. Experience has demonstrated that this often becomes the case and it further diverts the outcomes from the original project goals.

The description of the problem should be followed by suggestions for solving the problem. However, in most instances, the solution can be derived from the original specifications of the project methodology. Thus, there is a tendency to rewrite previous discussions which deal with specific aspects of the problem. In fact, the problems usually represent deviations from the proposed scheme. When methodology is properly applied, the resulting product will probably meet the rigid criteria established within the framework of original project specification.

The problems discussed in the report are divided into four major sections:

I: General Curriculum Development
II: Development of Specific Learning Units
III: Implementation
IV: Tryout and Revision

In some cases, problems associated with one section reappear, or may be solved in later sections. There are recurrent problem trends which persist, however, regardless of attempts to control or eliminate them. Many of these are associated with personnel changes occurring through the development phase. Particular sets of skills and attitudes are required to maintain consistent progress toward project goals. Training new personnel or re-training persons who have been on leave from the project for any duration limits the effectiveness of the products.

It is necessary to point out from the beginning that the responsibility for failure in any given dimension is a joint one. Inexact or incomplete coordination yields results which lack structural coherence and strength. Once the problems have been defined clearly, preventive courses of action can be specified and implemented.

It is hoped that the resulting report will specify problem dimensions with enough clarity to yield constructive resolutions for those attempting similar project efforts.

30 June 1967

DEVELOPMENT AND TRYOUT OF A JUNIOR HIGH SCHOOL STUDENT VOCATIONAL PLAN

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its ninth quarter of operation, 1 April through 30 June 1966. A brief overview of the project is presented first, followed by a report summary. This report describes the preliminary tryout of a Student Vocational Plan for junior high school. Project plans for the following quarter are also outlined.

REPORT SUMMARY

During this reporting period, technical activity centered on the development of learning units and of proficiency measures for vocational and academic courses of study.

The outline of a vocational guidance program for junior high school students was presented in the Fourth Quarterly Technical Report. This report describes the steps taken to translate the objectives into an operating program, to conduct the preliminary tryout of the Student Vocational Plan, and to establish a basis for immediate and long-term evaluation of the program.

In summary, this report reviews the significant characteristics of the guidance program, and describes the materials developed to support that program. Staff preparation, tryout procedures, and plans for future program implementation and evaluation are also described.

Activity in the next quarter will focus on the continued development of learning units and accompanying proficiency measures, arrangements for teacher preparation in using experimental curriculum materials, development of instruments to monitor the introduction of materials in the classrooms, and completion of guidance program revision and implementation in junior high schools.

31 May 1968

THE MATHEMATICS CURRICULUM

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its tenth quarter of operation, 1 April through 30 June 1968. A brief overview of the project is presented first, followed by a report summary. The major portion of the report addresses the problem of developing the mathematics curriculum learning units.

REPORT SUMMARY

During the present reporting period, technical activity concentrated on (1) crystalization of : curriculum unit topics, semester objectives, sequences of learning units, and syllabi for specific vocational areas, in mathematics, (2) analysis of the verbal and mathematical aptitude, ability and achievement characteristics of the mathematics student at Quincy, and (3) the development and testing of learning units in mathematics. The present report presents the history of this activity. It traces the development of the mathematics curriculum and displays the end product from its theoretical conception, to the identification of learning units, the establishment of semester objectives, the sequencing of the learning units, the formation of syllabi in specific vocational areas, the analysis of the learner population and the actual writing and testing of learning units. This report also includes a rationale for the curriculum as a whole and a rationale for the semester objectives.

During the next quarter, the development of curricula in the form of writing and testing learning units in other academic areas will constitute the major portion of technical activity. In addition, evaluation of the senior class guidance program will continue.

31 January 1969

THE ELECTRONICS CURRICULUM

ERIC Document Number ED 029 156

FOREWORD

This report, submitted in compliance with Article 3 of the contract, reports on technical activities of Project ABLE during its eleventh quarter of operation, 1 October through 31 December 1968. A brief overview of the project is presented first, followed by a report summary. The major sections of the report concern (a) the derivation of objectives for grades 10 and 11, and (b) the implementation and present evaluation of the grade 11 curriculum.

REPORT SUMMARY

This report describes the development, implementation, interim evaluation, and the probable future of the Project ABLE first and second level electronics curricula. The development stage of the project included the selection of jobs for training, the analysis of incumbent tasks, and the stating of course objectives in behavioral terms. The development stage was completed with the preparation of instructional materials which would lead the student, at his own rate, to the accomplishment of the stated objectives.

Implementation of the program, with continuing student and material evaluation, was the next phase (and well underway at the time of the preparation of this report). Most of the 18 students involved have accepted the responsibility for learning, and have demonstrated improved work and study habits. Student interest and progress is encouraging even to the casual observer. The attainment of objectives according to available data, has in some cases been lower than the established standards. However, revisions of the study materials and a refinement of the performance evaluations, according to recent tests, should remedy the problem areas.

Evaluation and revision of the materials on the basis of performance data will take place upon completion of the 1968-69 school year. Revised programs for 1969-70 will be operational for all first and second level students. The third level programs are presently under development and will undergo a limited test during the 1969-70 school year. Implementation of operational programs for fall of 1969 will include: (1) a non-graded electronics department for vertical and horizontal transfer irrespective of the school calendar, (2) a flexible program of individualized scheduling and course selection, (3) a limited test of the third level radio-television repairman and electronics technician programs, (4) the beginning of a third level cooperative work study program.

TWELFTH QUARTERLY TECHNICAL REPORT

July 1969

The Power Mechanics Curriculum

REPORT SUMMARY

This report describes the development of the Project ABLE Power Mechanics program. A brief review of the goals and objectives of the Project is included along with a rationale for the Power Mechanics curriculum.

The process was initiated by a careful analysis of occupations which formed what is termed a job family. The occupations were analyzed for common skills and knowledges. Also considered were job requirements, conditions, trends, and other factors. The jobs were then categorized and ranked by hierarchies of skills and knowledges. Training vehicles or representative jobs were then identified and a flow chart for the job family developed. Job descriptions and task enumerations were followed by a task analysis. Behaviorally stated objectives derived from the task analysis were translated into criterion tests called performance evaluations. Highly structured learning units were also developed to facilitate the implementation of a program of individualized instruction.

Major documents and samples of instruments, performance evaluations, learning units, and other materials are included in the report. A description of the initial procedures used in testing and revising, along with appropriate data, is provided. The report will serve as an administrator's and instructor's manual for institutions wishing to test the program. For this purpose, information is included for the organization, implementation and evaluation of the program. Training aids, tools, supplies, references, and items that are similar, are listed in detail.

September 1970

THE SOCIAL STUDIES CURRICULUM

REPORT SUMMARY

The contents of this report include the evolution of the Project ABLE three-year social studies curriculum for vocational students. It traces this development from the early meetings held by the advisory panel which set general social studies objectives for non-college bound students, through the writing of specific learning units designed to meet those behavioral goals, to the present activity of continued development and revision of learning materials. Particular attention is paid to the attempts at implementation and the problems associated with the evaluation of these learning units in an experimental classroom situation during the 1968-1969 school year in Quincy, Massachusetts.

FOURTEENTH TECHNICAL REPORT

September 1970

THE SCIENCE CURRICULUM

REPORT SUMMARY

This report describes the activities concerning the Science Program of Project ABLE in the Quincy Vocational-Technical School.

1. In accordance with the principles and purposes of Project ABLE, a Rationale was established, upon which the Science Program is based.
2. The next step was a statement of course objectives which relate to the Science areas incorporated in the program.
3. After the scope and the content of the Program were established in these two statements, a number of guidelines, techniques and rules of educational application had to be clarified for writing the curriculum. The use of audio-visual media, the selection of text and reference books, and the incorporation of experiments constituted an integral part of the development.
4. The individual Learning Activities were structured, a method of evaluation worked out and an instrument for measurement devised.
5. At the beginning of the school year 1968/69, the implementation of the first sets of developed material--Perception and Biological Science--was begun and continued through the school year. Concurrently in 1968/69, the writing of the Physics curriculum was continued and made ready for implementation.
6. Tasks remaining at the end of the reporting period were: (a) the analysis of student and teacher evaluations and its application in the procedure of revisions, and (b) the implementation of the remaining part of prepared curriculum and its revision.

April 1970

Management and Evaluation Plan for Instructional Systems Development for Vocational-Technical Education

REPORT SUMMARY

The report presents the Project ABLE management and evaluation plan for the implementation of experimental vocational curricula. A brief review of the goals and objectives of the project is included. A review of the literature is provided for the purpose of defining and clarifying the rationale for the management and evaluation plan for instructional system development. Major emphasis in the plan is given to formative evaluative procedures drawing on student performance data as the primary source of corrective feedback. The system is designed around an iterative process with the major goal of continuous program and product improvement. It is felt that such an approach would provide a regenerative element with self-renewal and updating taking place as a result of the evaluation, validation and follow-up activities. It is shown how test/revise/retest cycles can and should be perpetuated for as long as the program is in operation.

The primary evaluation instuments are derived from job and task descriptions and the subsequent specification of behaviorally stated performance objectives. This entails a detailed breakdown of the task activities and an identification of the "critical incidents" which are then translated into criterion checklist instruments. Criterion instruments, called "performance evaluation modules", are also developed from the task descriptions for the purpose of structuring replicable and reliable assessment situations. The performance evaluation modules are also designed to permit effective class management. While such instruments incorporate objective paper-pencil items, the emphasis is on the more important "hands-on" or practical performance skill test activities. Self-scoring response and feedback techniques with numerous simulators, mock-ups, samples, and other aids are emphasized in recognition of the critical role such devices play in a functional instructional system.

The entire developmental effort is characterized by a system approach centered around successive tryouts and systematic testing. Procedures for the design and application of developmental and evaluative instruments are presented in considerable detail. Sample materials are included along with flow charts, work sheets and various system control documents. Management procedures are defined and the entire process carefully documented. A plan for summative evaluation is outlined and guidelines suggested for appropriate application. Sample instruments for both formative and summative evaluation are included.

SIXTEENTH TECHNICAL REPORT

July 1970

The General Woodworking Core Curriculum

REPORT SUMMARY

This report describes the development of the Project ABLE General Woodworking Core Curriculum A brief review of the goals and objectives of the Project is included along with a rationale for the development of instructional systems.

The process was initiated by a careful analysis of a large number of occupations related in one way or another in the Woodworking family. This enabled the identification of a number of clusters or sub-families. Such occupations were then analyzed for common skills and knowledges. One method employed was a frequency count of common tasks utilizing a matrix of job titles by tasks performed. Also considered were job requirements, conditions, trends and other factors. Flow charts for job family training were developed. Job descriptions and task enumerations were followed by task descriptions and task analyses. Behaviorally stated performance objectives derived from the task analyses were translated into criterion tests called performance evaluation sets. Extensive documentation of such efforts is provided in the appendices.

Learner activity guides which include student-instructor options for maximum flexibility in selecting media and methods of instruction appropriate to each individual learner's needs, have been provided. Such devices are examples of attempts to meet major project objectives of individualization of instruction through the application of modern educational technology. Many documents and samples of instruments, performance evaluation modules, and other materials are included in the report. A description of the initial procedures used in testing and revising program materials is also included.

The report will serve as an administrator's and instructor's manual for those schools wishing to field test the instructional system. However, the report, for field testing applications, must be supported by descriptions and documents provided in the Project ABLE Fifteenth Technical Report, "The Management and Evaluation Plan for Instructional Systems Development for Vocational-Technical Education."

SEVENTEENTH TECHNICAL REPORT

September 1970

THE ENGLISH CURRICULUM

REPORT SUMMARY

This report discusses the development and implementation of an experimental tenth and eleventh grade English curriculum for vocational-technical students. The report includes an introduction which focuses on the educational methodology applied throughout the Project, the rationale for the English curriculum, a history of the early attempts at adapting English curricula for use with Project ABLE, a discussion of the development and implementation of the new curriculum, and recommendations for future implementation, adaptation and development. Samples of the materials developed for the English curriculum are appended to the report. These include the behavioral course objectives and samples of: learning units, student evaluations (tests), teachers' guides for implementation of units, and student reaction forms.

September 1970

TESTING OF THE GUIDANCE PROGRAM

REPORT SUMMARY

The Project ABLE Guidance Program was designed to prepare junior high school students for making an appropriate and stable choice of high school program. The guidance plan was implemented with over 4000 students in Quincy. Experimental and control groups were established to assess the effectiveness of the new program and materials.

Generally speaking, the results of the testing program were inadequate, with many inconsistencies occurring in the data and on the student score sheets. Serious questions can be raised about proper administration of the pre- and posttest, the proper use of the student kit materials, the proper use of the required reference and multi-media support materials, the premature city-wide testing of materials in need of editorial change (e.g., reading level too high), and other factors.

Funds for the support of staff for the proper revision of the student kit materials have not been readily available. However, the set of twelve Occupational Analysis reference manuals are more functional at this stage of development, and are considered valuable; their continued use is assured by the Quincy guidance staff. On the other hand, it is recommended that the student kit booklets for grades 7, 8, and 9 not be reprinted until appropriate revisions and modifications can be accomplished. It is felt that further refinement of the materials and administrative procedures, better implementation, and a more exhaustive investigation of students' performance are sure to lead to more positive results. It is strongly recommended that the effort to build on the foundation of the present program be continued, enabling the full potential of the basic research and development to be realized.

APPENDIX G

DEFINITIONS (MILITARY)

Constraints: Limiting or restraining conditions or factors, such as policy considerations, time limitations, environmental factors, and budgetary and other resource limitations.

Cost Effectiveness: A comparative evaluation derived from analyses of alternatives (actions, methods, approaches, equipment, weapon systems, support systems, force combinations, etc.) in terms of the interrelated influences of cost and effectiveness in accomplishing a specific mission or objective.

Course Control Documents: A set of specialized publications used to control the quality of instruction.

Criterion Objective: The specification of the behavior which leads to or satisfies a job performance requirement or standard. Criterion objectives specify precisely what behavior is to be exhibited, the conditions under which behavior will be accomplished, and the minimum standard of acceptable performance. See also enabling objectives.

Diagnostic Achievement Test: A test designed to provide insight into the student's learning problems, difficulties, or failures.

Education and Training Requirements: The qualitative and quantitative changes to be affected in the knowledges, skills, and attitudes of personnel selected to operate, maintain, or control a given system or subsystem. This includes formal instruction and on-the-job training which together meet job performance requirements and standards.

Enabling Objective: The behavioral specification of prerequisite skills and knowledges necessary for the achievement of a criterion objective.

Instructional Media: Devices and materials used as vehicles for the transmission of skills, knowledges, and attitudes required of the student in his attainment of course objectives.

Instructional System: An integrated combination of resources (students, instructors, materials, equipment, and facilities), techniques and procedures, performing efficiently the functions required to achieve specified learning objectives.

Instructional System Development: A deliberate and orderly process for planning and developing instructional programs which insure that personnel are taught the knowledges, skills and attitudes essential for successful job performance. This process is also known as Instructional System Engineering and Systems Approach to Training.

Job: The composite of duties and tasks actually performed by an individual.

Job Inventory: A listing of all tasks to be performed. A composite listing of job performance requirements and standards.

<u>Job Performance Requirement or Standard</u>: The tasks required of the human component of a system, including the associated standard of performance.

<u>Multi-Track Course</u>: A course which employs more than one track or channel of instruction. Course goals are the same on all channels, but course content, degree of instruction, and presentation will vary to accommodate students of different aptitudes and levels of previously acquired skills and knowledges.

<u>System</u>: The composite of equipment, skills, techniques (including all related facilities, equipment, materials, services and personnel) that is capable of performing and/or supporting an operational role.

<u>Subsystem</u>: A major functional subassembly or grouping of items of equipment which is essential to the operational completeness of a system.

<u>Task</u>: A unit of work activity or operation that constitutes a logical and necessary step in the performance of a duty.

<u>Training Aid</u>: A device, usually consisting of actual equipment components, used to familiarize the learner with the equipment or item and its operation or use.

<u>Trainer</u>: A job performance oriented device designed to

simulate conditions inherent in the equipment which it represents.

APPENDIX H

ELECTRONICS OBJECTIVES

ELECTRONICS MECHANIC

COURSE OBJECTIVES

Task 1 Removes electronic components.

Task 2 Installs electronic components.

Task 3 Interprets drawings, sketches, schematics, and wiring diagrams.

C.O.1 Given a schematic, pictorial, layout, or wiring diagram, and the corresponding electronic or electro-mechanical equipment, worker can locate on the equipment any point, component, part, module, or unit specified by the schematic, pictorial, layout, or wiring diagram, and do so without error in a reasonable length of time as determined by the complexity of the equipment.

C.O.2 Given any electronic or electro-mechanical equipment, worker can sketch a layout, wiring, pictorial, or schematic diagram of any specified section of the equipment and do so without error in a reasonable length of time as determined by the complexity of the equipment.

Task 4 Measures voltage, resistance, current, frequency and phase.

C.O.1 Demonstrates competence in knowledge of characteristics and use of volt-ohmmeters, vacuum tube voltmeters, and oscilloscopes (as voltage measuring devices) by--

a. Selecting the appropriate instrument, stating the reasons for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instrument selected.

The actual situations must involve DC, sinusoidal AC, and non-sinusoidal AC voltage measurements in both low and high impedance circuits.

C.O.2 Demonstrates competence in knowledge of characteristics and use of volt-ohmmeters, vacuum tube voltmeters, and Wheatstone bridge (as resistance measuring devices) by--

a. Selecting the appropriate instrument, stating the reasons for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instrument selected.

C.0.3 Demonstrates competence in knowledge of characteristics and use of volt-ohmmeters, vacuum tube voltmeters, and watt-meters, (as applied to power measurements) by--

a. Selecting the appropriate instrument(s), stating the reason for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instruments selected.

The actual situations should include both input and output power measurements of both DC and AC devices (both AF and RF).

C.0.4 Demonstrates competence in knowledge of characteristics and use of volt-ohmmeters, amprobes, and multi-range ammeters (as current measuring devices) by--

a. Selecting the appropriate instrument, stating the reasons for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instrument selected.

C.0.5 Demonstrates competence in knowledge of characteristics and use of counters, oscilloscope-generator combinations, and frequency meters (as frequency determining devices) by--

a. Selecting the appropriate instrument, stating the reasons for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instrument selected.

The frequencies involved must lie in the AF and the RF ranges.

C.0.6 Demonstrates competence in knowledge of characteristics and use of oscilloscopes and phase meters (as phase measuring devices) by--

a. Selecting the appropriate instrument, stating the reasons for each selection.

b. Making the appropriate instrument settings and circuit connections, and obtaining the desired results within the maximum precision capability of the instrument selected.

Task 5 Relates measured values to specified values to locate malfunctions.

C.O.1 Given the schematic diagram of any circuit found in one of the following groups, student can describe such parameters as approximate voltage amplitudes, input-output voltage waveforms, and voltage phase or time relationships found across the various components of the circuit.

a. Single phase and polyphase rectifier power supplies.
b. Voltage multipliers.
c. DC, AF, and RF amplifiers.
d. Sinusoidal and non-sinusoidal oscillators.
e. Detectors and demodulators.
f. Modulators.
g. Gates.
h. Triggering circuits.
i. Wave shaping circuits

C.O.2 Demonstrates competence in troubleshooting any piece of electronic or electro-mechanical equipment by combining appropriate procedures described in previous objectives.

Task 6 Tests components for conformity to specifications.

C.O. Demonstrates competence in testing components for conformity to specifications in the following manner. Given a component, student can determine theoretical specifications by reading the component's color code (if feasible) or referring to a specifications sheet or manual, determine an appropriate piece of test equipment or test procedure, set up the test in accordance with standard test methods, and obtain the actual values of the component. Students can then compare the actual values with the specified values and make a decision as to whether the component lies within specifications.

Task 7 Disassembles, repairs, and reassembles mechanical assemblies.

Task 8 Uses standard electronic hand tools.

Task 9 Selects parts by comparing circuit requirements with catalogs.

C.O. Given the schematic diagram of any electronic circuit with parts labeled, student can discern the parameters of any given component and, by consulting parts catalogs and specifications sheets, can specify by manufacturer and part number the actual parts and/or hardware from which the circuit can be built.

<u>Task 10</u> Interprets schematic diagrams to determine circuit parameters and theoretical operation.

<u>Task 11</u> Performs simple calculations to determine practicability of using substitute parts.

C.O. Demonstrates competence in performing simple engineering calculations to determine practicability of using substitute replacement parts when specified parts are unavailable.

<u>Task 12</u> Records in semi-permanent form, the results of tests, repair, and service.

<u>Task 13</u> Visually inspects electronic circuits.

<u>Task 14</u> Adjusts electronics components to cause circuit operation within specifications.

C.O.1 Given a five-tube superheterodyne radio receiver and the availability of applicable test equipment, student can select appropriate test equipment and align the receiver in accordance with standard procedure and within the accuracy limits of the available equipment.

C.O.2 Given a communications receiver, student can select required test equipment and completely align and calibrate the receiver within the accuracy of the available equipment.

<u>Task 15</u> Supervises and instructs other personnel in operating procedures, equipment, functions, and other technical subjects.

C.O. Given a specific repair job or equipment operation requirement in which the student has previously demonstrated an acceptable level of competence, student must demonstrate ability to instruct other personnel in operating procedures, equipment functions, and other technical subjects by training an incompetent student on the given repair job or operation to a degree where he can demonstrate competence according to the standards specified in the appropriate objective.

<u>Task 16</u> Follows both verbal and written instructions.

<u>Task 17</u> Selects instruments required for specific tests.

<u>Task 18</u> Keeps parts inventory and repair records.

APPENDIX I

SELF-SCORING RESPONSE FORM

VAN VALKENBURGH, NOOGER & NEVILLE, INC.

NAME ______________________ RIGHT ______ WRONG ______

CLASS/COURSE ____________ MODULE/TEST NO. ____________ SCORE ______

DATE ____________ TIME ____________ ITEMS OF DIFFICULTY ____________

Self-Scoring TRAINER-TESTER* Response Card

PATENTED · VVN&N · TRADEMARKED

Directions—Veriable Alphabeticel Response Mode:
Erese the block where you think correct enswer is. Preferebly use cleen, firm, non-plestic pencil ereser, with reesonebly sherp edge. Your Instructor will designete the correct enswer response for e perticuler exercise, for exemple:

Correct Answer Designeted:		Then other responsees ere:	
"T" = Right	etc.	"H", "E" or "L" = Wrong	etc.
"H" = Right		"T", "E" or "L" = Wrong	

If your Instructor wishes you to leern the correct enswer, continue eresing until the response designeted es correct is reveeled; meke es few eresures es possibie. For self-ecoring, greding end item-of-difficulty identificetion see Direction Sheet.

Item of Difficulty Mark

ITEM NUMBER (UNIT)	ANSWER RESPONSE/CORRECTIVE FEEDBACK (a)	(b)	(c)	(d)	SCORING POINTS
1					____
2					____
3					____
4					____
5					____
6					____
7					____
8					____
9					____
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19					____
20					____
				Total	____
21					____
22					____
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35					____
36					____
37					____
38					____
39					____
40					____
				Total	____

DEC 1970 50

T-T No. Z11
Second Series

APPENDIX J

CRITERION CHECKLIST

QPS/AIR/ABLE
Power Mechanics
DOT #915.867
Unit PE #10-3

Student ____________________

Date __________ Instructor __________

TESTING ANTI-FREEZE

L	M	S

Tests and adjusts anti-freeze.

Instructor Checks:

1. Correctly answers 80% (4) of the training check questions. U | S
2. Identifies the specifications and information necessary for accurate testing and adjustments.
   a. Cooling system capacity in quarts. U | S
   b. Quarts of anti-freeze required for a given minimum protection level for a variety of vehicles. U | S
   c. Quarts of anti-freeze required for a 50% concentration. U | S
   d. Service requirements of vehicle. U | S
   e. Number of quarts required to reach a lower level of protection. U | S
3. Determines the freeze point or level of protection (±5°F) of a cooling system using two types of testers.
   a. Observes safety precautions. U | S
   b. Adjust coolant level following specified procedures U | S
   c. Accurately tests coolant with small (colored balls) type tester. U | S
   d. Accurately tests with standard anti-freeze hydrometer. U | S
4. Performs tasks in an appropriate amount of time. U | S

APPENDIX K

SAMPLE MODULE

PERFORMANCE EVALUATION SET
& LEARNER ACTIVITY GUIDE

POWER MECHANICS

FAMILY: AUTO MECHANICS & RELATED OCCUPATIONS
EXIT LEVEL: SERVICE STATION ATTENDANT & RELATED OCCUPATIONS

CHASSIS LUBRICATION
PE 11-6

Project ABLE
Quincy Public Schools
American Institutes for Research

PERFORMANCE EVALUATION SET
& LEARNER ACTIVITY GUIDE

POWER MECHANICS

Family: Auto Mechanics & Related Occupations.

Exit Level: Service Station Attendant & Related Occupations.

(915.867)
LEVEL I

CHASSIS LUBRICATION
PE 11-6

TASK 12 | C. O. 1 & 2

NAME ______________________

DATE ______________________

LEARNER ACTIVITY GUIDE

PREREQUISITES: PE 3-1 and PE 11-1 through 11-5

OBJECTIVES: Given an auto to be lubricated, you will:

1. Use a service manual lube chart to locate and clean lubrication points in front suspension, steering linkages, drive and power lines, cables and linkages, etc.

2. Identify the proper tools and adapters and apply the specified type and amount of lubricant without dirt or foreign materials entering the system. Follow the lubrication chart directions for the specific make, model, and year of car.

3. Check lubricant level in differential, manual transmission, manual steering gear, and power steering reservoir. Identify proper lubricant.

4. Identify and lubricate to specifications, various under-the-hood lubrication points.

(Continued)

PROJECT ABLE

<u>OVERVIEW</u>: Most cars and trucks have lube points on the underbody which are exposed to rugged operating conditions. The steering and suspension systems, with ball joints and bearings, are the major underbody lube points. Careful servicing is important. While older vehicles are equipped with grease "fittings" for such joints, most new cars are now sold with pre-packed bearings. The servicing interval for most <u>fitting-equipped</u> points is from 1,000 to 4,000 miles. The recommended servicing interval for <u>pre-packed</u> bearings ranges from 12,000 miles to 36,000 miles (or from 12 months to 36 months). You must know that the method of lubrication is different for the two types. Greasing a pre-packed bearing like those equipped with standard fittings could ruin the bearing seals. Furthermore, a different type of grease is usually required. Chassis lubrication is one job you should not attempt without the careful supervision of the instructor or mechanic.

<u>STUDENT-INSTRUCTOR CONTRACT OPTIONS</u>:

- ☐ 1. Student-instructor conference.
- ☐ 2. Learning Unit #11-6.
- ☐ 3. <u>Chek-Chart's Car Service</u>, Chek-Chart Corporation, pp. 49-54.
- ☐ 4. Other--specify: ______________________.

<u>EQUIPMENT</u>: Tote-Tray #11-6 with lube chart manual, penetrating fluid, oil can with 10W30 oil, hand lubrication gun, adapters for pre-packed bearings, and assorted wrenches. Get some paper towels.

POWER MECHANICS
Family: Auto Mechanics & Related Occupations.
Exit Level: Service Station Attendant & Related Occupations.
(915.867)
LEVEL I

CHASSIS LUBRICATION
PE 11-6

NAME ____________

DATE ____________

TASK 12 | C. O. 1 & 2

Pre Assessment

Instructions;

(1) Fill in name and date on the last two pages. When you have completed the performance evaluation, you will get one copy, the instructor will file the other.

(2) Do the training check questions below and give answer card to instructor.

(3) Complete the performance evaluation under instructor's supervision. He must see proof of your performance.

TRAINING CHECKS: T-T No. Z-11. The correct answer is **L**. Start with number **17**.

17. Dirt must be removed from fittings and plugs

    a. to make a path for excess grease.
    b. to prevent foreign materials from entering bearing.
    c. to see the bearing.
    d. to present a neat appearance.

18. To remove the grease gun from a fitting after greasing the lube point

    a. unscrew fitting.
    b. pull straight off.
    c. break by moving up, down, or sideways.
    d. pull trigger and pop out.

19. Limited slip differentials can always be detected by

    a. checking drain plug for metal tag.
    b. checking manual for specifications.
    c. checking special type of grease in differential.
    d. rotating a rear wheel and observing opposite wheel.

20. The service interval for bearings with standard fittings and for pre-packed bearings is

    a. much longer for pre-packed bearings.
    b. determined by the mechanic.
    c. longer for the standard fitting equipped bearings.
    d. about the same.

21. The pressure gun

    a. can be used on pre-packed bearings by changing only the grease.
    b. can be used on pre-packed bearings with no modifications.
    c. should not be used on pre-packed bearings.
    d. should not be used unless the nipples are changed.

22. Limited slip differentials

    a. use a different grease than used in standard differentials.
    b. use the same grease furnished for standard differentials.
    c. are serviced the same as any other differential.
    d. require no special care.

23. The lubricant for manifold heat-control valves should be

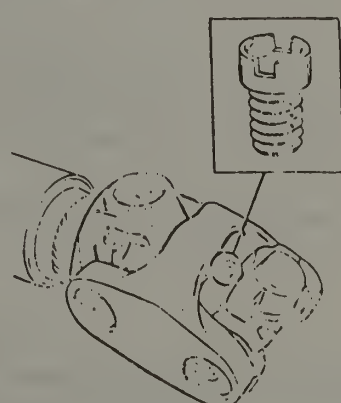
    a. Door-Ease or silicon spray.
    b. penetrating fluid or similar lubricant.
    c. flake graphite.
    d. SAE 20 oil.

Identify the following (put a check mark next to the correct letter)

24. Standard nipple plug.

    a. ______
    b. ______
    c. ______

b.



25. Pre-packed bearing plug.

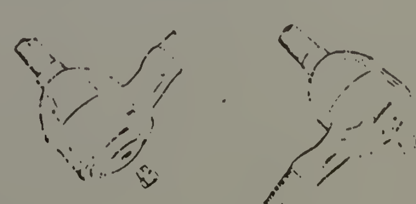
    a. ______
    b. ______
    c. ______

26. Flush type plug.

    a. ______
    b. ______
    c. ______

c.

a.



27. When the lubricant in a differential, steering reservoir, or transmission is very low, you should

    a. recommend the owner return it at a later time for service.
    b. recommend draining and refilling unit with new fluid.
    c. simply fill to proper level with specified lubricant.
    d. add gear grease.

28. Vehicles should be allowed to warm up indoors before greasing when the temperature approaches

    a. 0°F.
    b, -10°F.
    c. +10°F.
    d. +20°F.

29. When attaching grease gun to fitting,

    a. push straight onto fitting.
    b. touch lightly and apply grease.
    c. pull trigger and shove.
    d. place on angle and roll on.

30. Most new cars are sold with

    a. pre-packed bearings for most front-end lube points.
    b. standard grease fittings for most lube points.
    c. standard grease fittings for all lube points.
    d. standard nipple plugs for most lube points.

31. Standard fittings and pre-packed bearings

    a. require the same type of grease.
    b. differ only in the service interval.
    c. are serviced with the same tools and fittings.
    d. require a different type of grease.

32. Greasing either pre-packed bearings or bearings equipped with standard fittings.

    a. is recommended procedure.
    b. could ruin the bearing seals.
    c. requires essentially the same tools but different grease.
    d. requires essentially the same grease but different tools.

STOP ________________ INSTRUCTOR CHECK #1
initials

POWER MECHANICS
Family: Auto Mechanics & Related Occupations.
Exit Level: Service Station Attendant & Related Occupations.
(915.867)
LEVEL I

CHASSIS LUBRICATION
PE 11-6

TASK 12 C. O. 1 & 2

NAME ____________________
DATE ____________________

PERFORMANCE ACTIVITY
(Pre and/or Post Assessment)

UNIT OBJECTIVE 1:	Using a service manual lube chart, locate and clean lubrication points in front suspension, steering linkages, drive and power lines, cables and linkages, springs, etc.

A. ____________ year ____________ make ____________ model ____________ mileage

When was the vehicle last greased? ____________ miles ____________ date

B. What is the recommended lubrication service interval?

____________ miles ____________ months

Does the mileage or time interval indicate the need for greasing? ____________________

C. How many plugs are listed? ____________________

How many fittings are listed? ____________________

What type of plugs or fittings are listed?

____

____

____

#33. Do all plugs and fittings require the same type of lubricant?

a. No b. Yes

D. Complete the following information:

Differential

Type ______

Service Interval ______

Lubricant ______

Is service required? ______

Transmission-Overdrive (or Automatic Transmission)

Type ______

Service Interval ______

Lubricant ______

Is service required? ______

Steering

Type ______

Service Interval ______

Lubricant ______

Is service required? ______

E. Raise vehicle following procedures listed in unit on lifts and jacks.

F. Prepare the plugs for greasing--do NOT grease until after the instructor check below.

What type plug or fitting is used? ______

Were the plugs changed? ______

Were the plugs originally of the pre-packed type? ______

UNIT OBJECTIVE 2:	Identify the proper tools and adapters and apply the specified type and amount of lubricant without dirt or foreign materials entering the system. Follow the lubrication chart directions for the specific make, model, and year of car.

A. Get the hand gun. It should be filled with the lubricant specified for pre-packed bearings. Is it the type of lubricant specified by the manual? _______________ Do NOT grease anything yet.

#34. Get the pressure gun. Does it have the type of lubricant specified for standard nipple-type fittings?

a. No b. Yes

NOTE: The pressure system has the wrong type of grease for pre-packed bearings. NEVER use the pressure gun on sealed pre-packed bearings. The pressure would break the seals--this could void the warranty.

NOTE: No student (10th, 11th, or 12th grade) is allowed to grease fittings without first having the job inspected by the instructor.

STOP _______________
initials

INSTRUCTOR CHECK #2:
Check written work. Check identification of fittings. Student must be able to identify pre-packed bearings. Make certain he has identified and cleaned all lube points. Check for limited slip differential. Have student identify plugs on differential and transmission. Have student demonstrate use of hand gun and pressure gun. Watch him perform. Make certain he keeps fittings and nozzle VERY clean. Have student demonstrate turning of wheels while greasing ball joints or king pins.

B. Do NOT attempt to grease a universal joint or drive shaft without instructor's assistance. Lubricate the first few points with instructor's help.

C. Lubricate all fittings and plugs as indicated on chart. Use proper lubricant.

UNIT OBJECTIVE 3:	Check lubricant level in differential, manual steering gear, power steering reservoir, and manual transmission-overdrive unit.

Differential

A. What type of lubricant is specified for the standard differential? _______________ What type of lubricant is specified for the limited slip differential? _______________ (Check the service chart for some other make of car if both are not listed for the vehicle you are servicing.) Does the vehicle have a limited slip differential? _______________

B. Find and prepare plug--do NOT remove until checked by instructor.

STOP _______________ initials

INSTRUCTOR CHECK #3:
Have student remove plug, check level, and replace plug. Did student inspect for leaks and broken seals?

C. Is lubricant required? _____________ Fill only by permission of instructor.

NOTE: Do not lower car to ground until instructor checks plug.

Manual Transmission

#35. What type of lubricant is specified?

a. A.T.F.

b. SAE 90-140

c. SAE 10W30

d. SAE 30

A. Find and prepare plug.

NOTE: Do not remove fill plug until checked by instructor. Should the car you have been servicing have an automatic transmission, go to another vehicle for this part of the project.

STOP _______________ initials

INSTRUCTOR CHECK #4:
Have student remove plug, check level, and replace plug. Did student inspect unit for leaks?

B. Is lubricant required? _______________

Fill only by permission of instructor.

Steering Gear (units without power steering)

#36. What type of lubricant is specified?

a. Chassis lube

b. A.T.F.

c. SAE 10W

d. SAE 90-140

A. Find and prepare plug.

STOP ________________ INSTRUCTOR CHECK #5:
initials Have student loosen fill plug, check fluid level, and replace plug.

B. Is lubricant required? ______________

Do not add lubricant without instructor's or mechanic's permission.

Power Steering Reservoir

#37. What type of lubricant is specified?

a. A.T.F.

b. SAE 10W

c. SAE 10W30

d. SAE 90-140

A. Find and prepare cover or fill cap.

Some older cars with power steering have two separate lube points: (1) the power steering unit reservoir and (2) the steering gear box. In new vehicles, the power steering reservoir supplies the gear box with lubricant. Your instructor can explain this.

B. Remove cap and check level. Is lubricant required? ________

Fill only by permission of instructor.

UNIT OBJECTIVE 4: Identify and lubricate, to specifications, various under-the-hood lubrication points.

Manifold Heat-Control Valve

#38. What is the specified lubricant?

a. SAE 30

b. A.T.F.

c. Penetrating oil

d. SAE 90-140

A. Lubricate.

Throttle Linkage

A. What is the specified lubricant? ____________________

B. Point out lube points to instructor--from manual.

C. Lubricate.

Other Accessories

A. List four (4) other lubrication points listed in manual. (Points not covered in this project.)

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________

STOP ____________________ initials

INSTRUCTOR CHECK #6:
Check steps in power steering, manifold heat-control valve, throttle linkage, and "other accessories".

APPENDIX L

MATHEMATICS AND ENGLISH PLANS

A PROPOSAL FOR INDIVIDUALIZING ALL THE PRACTICAL MATHEMATICS PROGRAMS FOR THE VOCATIONAL-TECHNICAL SCHOOL STUDENTS AND ANY OTHER NON-COLLEGE BOUND AND NON-BUSINESS EDUCATION STUDENTS.

The Mathematics Department of Quincy High School presents this proposal which we feel epitomizes the goals of ES'70 and the individualized learning process to which the Quincy Public School System has said it is committed.

A. From out experience with the ABLE and PLAN materials, we feel that we can revise present ABLE materials to do two vital things not done presently:

   1. Relate the "ABLE" "core" mathematics units to relevant problems in the trade areas and general practical problems to which students need exposure in our society.

   2. Set up assignments for accomplishing objectives for various individualized reading and ability levels using regular texts, programmed texts and multi-media materials.

B. In developing necessary new or additional units for the newly structured Advanced Practical Math. I, II and Developmental programs we feel that we can make a marriage of "ABLE" and "PLAN". We can come up with a unit or module format which encompasses the best of what each now does, but additionally covers the two vital items listed under "A" above.

Attached are samples of a current ABLE and PLAN unit or module. Also attached is a sample of an additional page we would attach to a revised ABLE unit to accomplish "A" above. Thirdly, you will find a sample of what we might devise to cover a topic and objectives as outlined under "B" above.

Now down to the nitty gritty of the cost to accomplish what is being advocated:

$1,100.	Xerox reproduction of current ABLE units to handle estimated student enrollment.
350.	Xerox reproduction of units developed during summer.
1,800.	300 man-hours for revision and development of ABLE units during summer based on current contract rate of $6. per hour.
750.	Clerical work for the typing and reproduction of units.
No Cost	Collating of units.
No Cost	Textbooks, programmed texts, filmstrips, tapes, etc. can be obtained through existing available budgets. (We think we will need $100. for A-V hardware filmstrip viewers, but even this we feel could be obtained under some existing source.)
$4,000.	TOTAL COST

ENGLISH PROPOSAL TO ENABLE MORE THOROUGH INDIVIDUALIZATION

From the experience of the two programs, ABLE and PLAN, the English Department needs to have available for use many of the units and modules developed by the two programs for many of the classes not designated as ABLE or PLAN. Teachers of both programs have shared their materials as generously as we have indicated need, but to have them duplicated and perhaps made available for all from the English office would facilitate more extensive use.

To that end, the duplication of the selected ABLE materials should be provided.

The English Department of Quincy High School, therefore, submits this proposal which we feel will enable more thorough individualization in the language arts area.

We propose:

A. to make a major revision of student evaluations and to clean up materials for general classroom use.

B. to provide the basic English classes, which are primarily Vocational-Technical students, with materials that will enable the teacher to tutor the slow learners.

C. to provide the standard English classes with teacher-guided supplemental materials.

To accomplish the necessary revision and general preparation of materials satisfactorily, the cost will be:

\$3,686.	Xerox reproduction of ABLE units for projected classroom use.
2,800.	700 man-hours for revision and development summer work: two teachers @ \$6.00 per hour.
222.	Audio-visual hardware and software.
500.	Clerical--Typing
\$7,208.	TOTAL COST

APPENDIX M

GREAT CITY SCHOOLS CORRESPONDENCE

February 5, 1970

Mr. Stewart Sargent
ES '70 Corrdinator
Mr. J. Wm. Ullery
Project Director and
Associate Research Scientist
Project ABLE
Quincy VOTEC School
Quincy, Mass. 02169

Dear Mr. Sargent and Mr. Ullery:

The purpose of this letter is to confirm and to qualify our discussions and agreements on the cooperative dissemination and testing of Project ABLE instructional systems.

The major objectives are as follows (not ordered):

1. Establish immediately (February 1970), a cooperative operational curriculum development, dissemination, and testing effort among three ES '70 school systems (Quincy, Baltimore and Philadelphia) in one course area. (Expansion to other network members can be considered after initial negotiations are completed and operational problems brought under control.)

2. Establish guidelines and procedures to set up the machinery for the dissemination and testing of the Project ABLE general woodworking core program and the ABLE electronics programs for implementation Spring of 1970.

3. Identify givens, conditions, and criteria for the development by each system (Quincy, Baltimore and Philadelphia) of specific instructional systems components (e.g. power mechanics). This will be accomplished through an administrative arrangement for the joint development, dissemination and testing of such components. (Components are also defined as those key operational elements, described in the paper presented by Mr. Ullery at AVA, for the establishment of the kind of individualized programs congruent with the ES '70 and Project ABLE philosophy.)

4. Disseminate, field test and appropriately evaluate the first level power mechanics program (within the guidelines established in the Project ABLE Validation and Evaluation Plan).

5. Establish an exemplary program involving local, state and teacher training institutions in a manner suggested in the "Model Proposal" for the first level power mechanics program and to establish the framework for other such programs.

6. Validate the developmental, evaluation and managerial procedures established in the Validation and Evaluation Plan for Project ABLE.

Because it is critical that action be taken immediately on the power mechanics dissemination and testing, the Model Proposal will become a concurrent activity which may or may not require outside funding (a local option). Action on Objective #1 has already been initiated. A subsequent letter will detail our agreements and procedures on this matter. Action on #6 will, in part, be achieved in the proper field testing of the power mechanics program and the implementation of Objectives #2 and #3.

Respectfully,

George H. Love
ES '70 Coordinator

William T. Kelly
Director of Vocational Education

cc: Dr. Mark R. Shedd
Dr. Thomas D. Sheldon
Mr. Samuel Sharrow
Dr. Benjamin Whitten
Dr. Hugh Livingston
Mr. Eliot G. Spack
Dr. Lawrence P. Creedon
Mr. Maurice J. Daly
Mr. J. S. Nicastro

February 17, 1970

Dr. William T. Kelly
Director, Vocational Education
734 Schuylkill Avenue
Philadelphia, Pennsylvania 19146
&
Mr. George H. Love
ES'70 Coordinator
School Dist. of Philadelphia
21st and Parkway, Room 208
Philadelphia, Pennsylvania 19103

Dear Dr. Kelly and Mr. Love:

We have received both of your letters dated February 5th, 1970 delineating our discussion on cooperative testing and possible joint development of Project ABLE programs. The statements are acceptable to Quincy and A.I.R., and should provide a workable set of agreements and procedures for the initiation of "...this most unique joint and cooperative effort". The detail of the letters and the procedures set forth in the "Project ABLE Checklist of Instructor Performance", along with the instruments being developed for the "Project ABLE Validation and Evaluation Plan for Instructional Systems Development" should insure an appropriate test of the Power Mechanics program.

Sincerely,

PROJECT ABLE

Stewart S. Sargent
ES'70 Coordinator, Q.P.S.

J. William Ullery
Project Director and
Associate Research Scientist, A.I.R.

cc: Dr. Creedon
Mr. Daly
Mr. Nicastro
Dr. Flizak
Dr. Whitten
Mr. Sharrow

APPENDIX N

FINAL REPORT, COUNCIL OF THE GREAT CITIES SCHOOLS

Final Report

Grant OEG-0-71-0927(510)

Council of the Great City Schools
1819 H Street, N.W., Suite 850
Washington, D.C. 20006

CURRICULUM DEVELOPMENT IN VOCATIONAL EDUCATION (ORGANIZATIONAL PHASE)

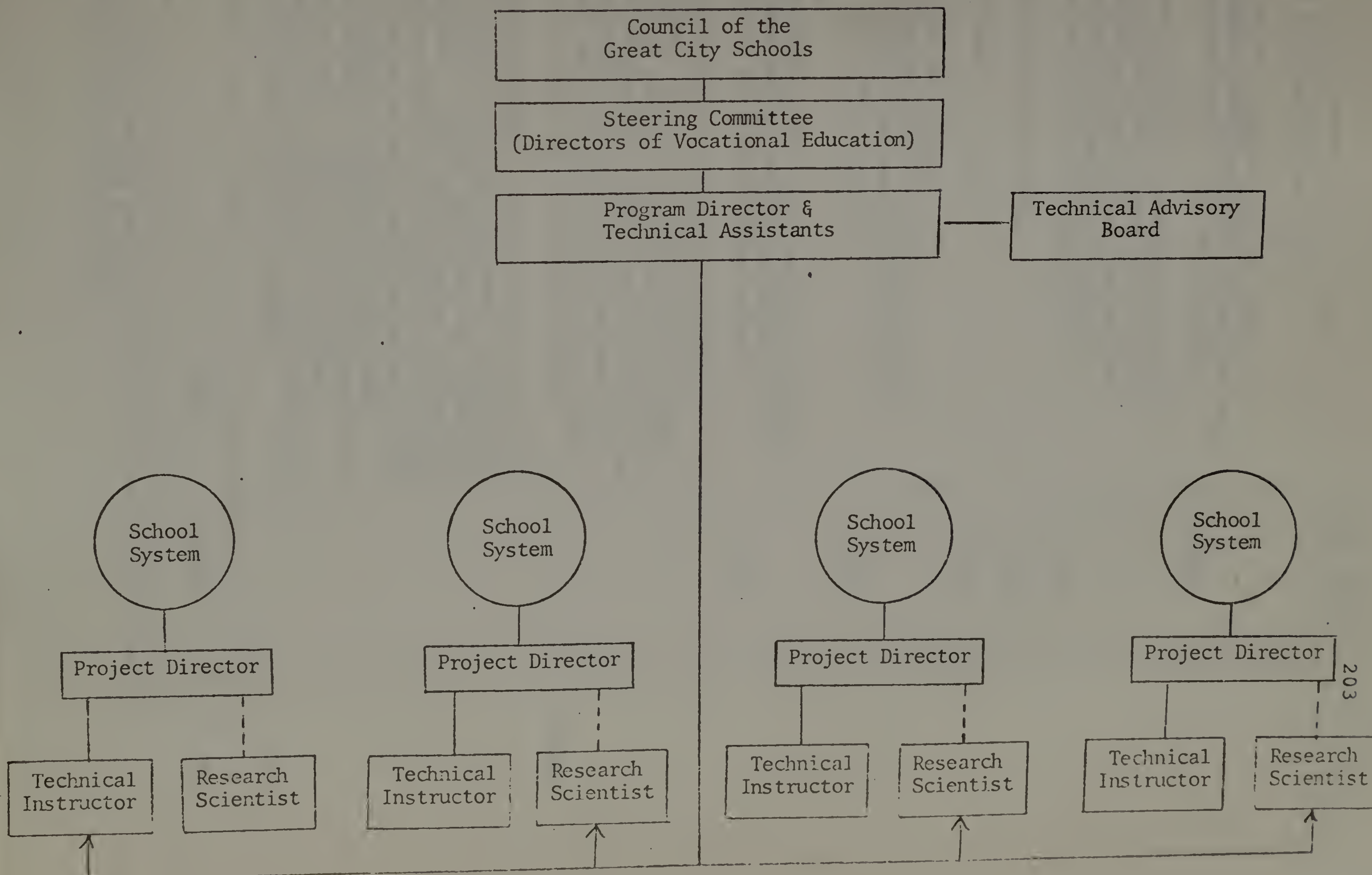
October 29, 1971

U.S. Department of Health, Education, and Welfare

Office of Education

National Center for Educational Research and Development

PROPOSED ORGANIZATIONAL CHART

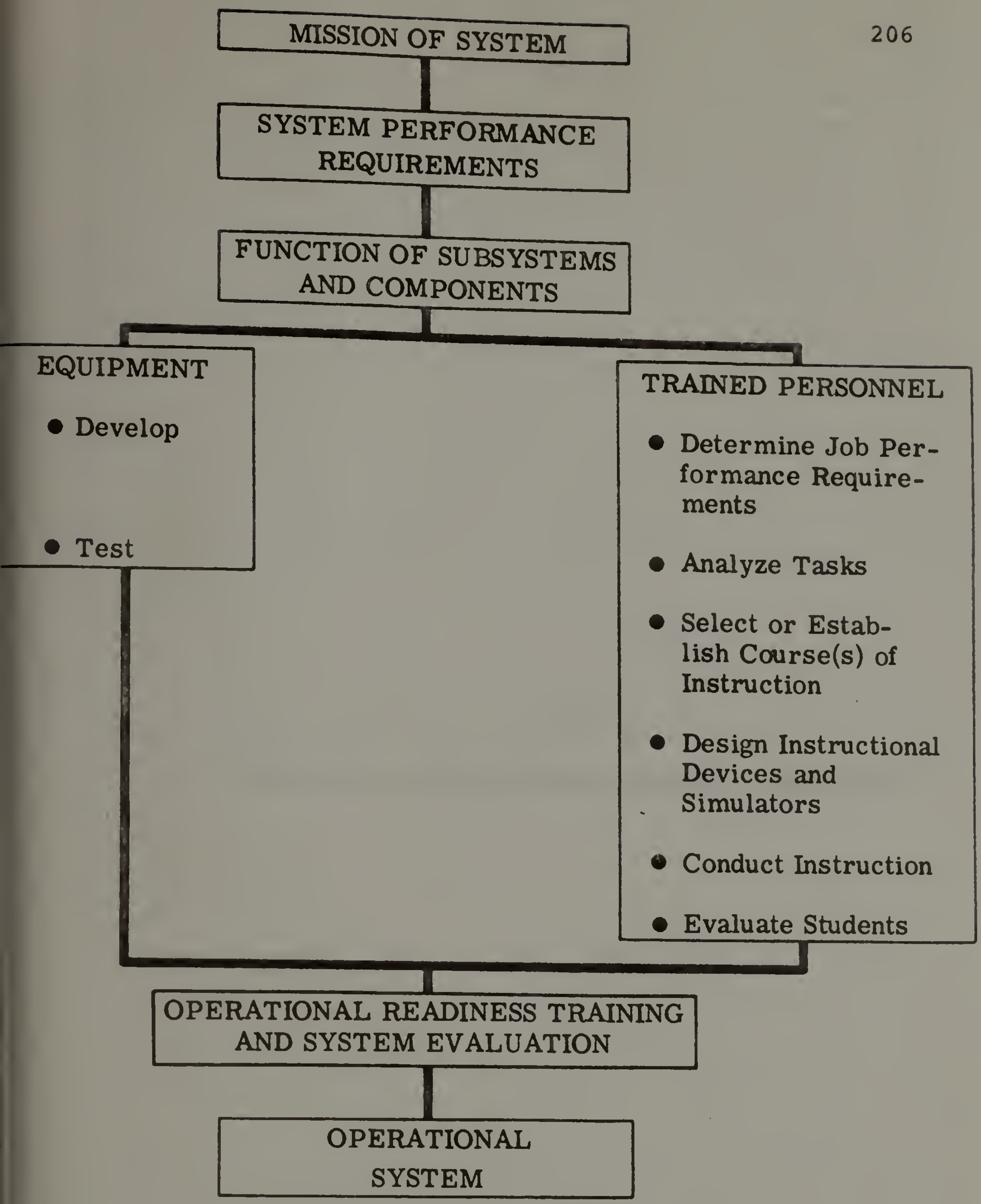


	Local and/or State Funds	State and/or Federal Funds*
Local Technical Support Staff		
3 persons @ approx. $14,000 each (Administrative overhead and services and employee benefits are not included.)	$42,000	
Secretarial/Clerical--assuming availability of considerable student clerical help (Administrative overhead and services and employee benefits not normally computed for public employees.)	6,000	
Communications and Postage	2,000	
Consultants and Services	1,000	
Materials and Supplies (Includes initial expanding activity in the various new areas being developed by other member systems.)	5,000	
Travel (Includes staff members receiving training in the various job families under development in the various member systems.)	3,000	
Research Scientist assigned to individual systems, one per job family. Costs shown include administrative overhead rates which may be about 32.6% depending on Federal government audit. Salary projections based on mean salary for Research Scientists. Costs also include 25% for employee benefits.		$26,000
Central Management: (Includes Program Director, Technical Assistants, dependent on number of job families under operation, and secretarial-clerical. Also, administrative overhead and employee benefits, communications and postage and extensive travel among the member systems for management personnel. Policy Board and Technical Advisory Board meetings--one or two per year. Materials and supplies. Consultants and services. Projections based on a 20 school system involvement.		20,000
TOTAL	$59,000	$46,000

*Until Federal funding patterns become clear, plans should be made for funding through state agencies.

TABLE 1.

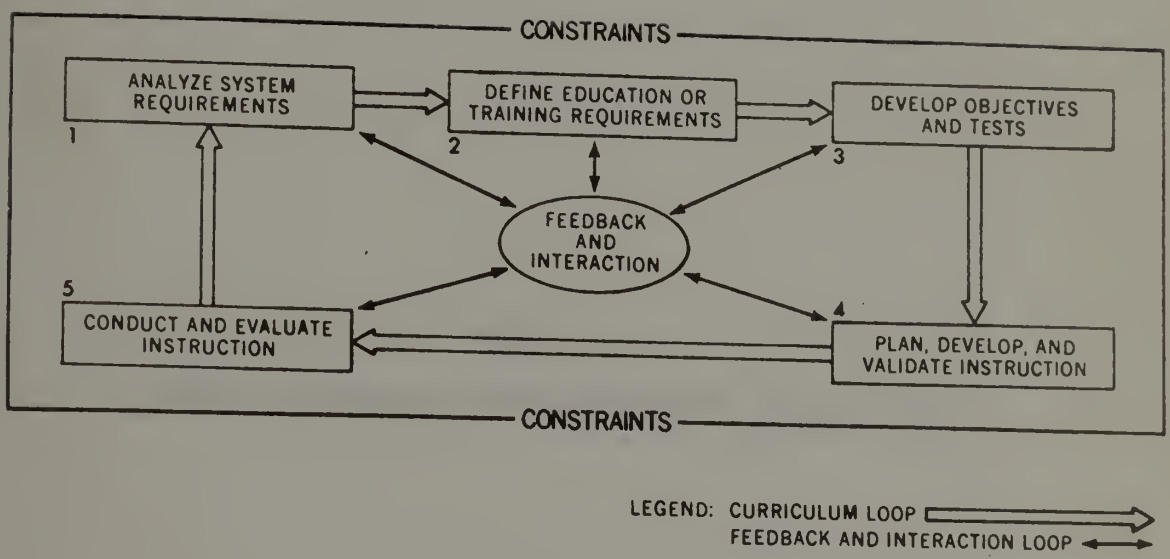
TYPICAL SYSTEM DEVELOPMENT CYCLE



Typical System Development Cycle

TABLE 2.

MODEL FOR INSTRUCTIONAL SYSTEMS DEVELOPMENT



Model for Instructional System Development

TABLE 3.

PROGRESS CHART, POWER MECHANICS CURRICULUM

PROGRESS CHART

JOB TASKS	DEVELOP PERFORMANCE OBJECTIVES	DEVELOP & VERIFY CRITERION INSTRUMENT	TEST REVISE/RETEST CYCLE	DEVELOP LEARNER ACTIVITY GUIDES	PROCURE EQUIPMENT AND SUPPLIES	IMPLEMENT MODULES INDIVIDUALLY REVISE/ RETEST CYCLE	IMPLEMENT SYSTEM	TEST REVISE/RETEST CYCLE	FOLLOW-UP ON GRADUATES AND VALIDATE	REVISE/RETEST CYCLE
	DEVELOPMENTAL PHASES									
1. Perform minor engine tuneups.										
2. Check or inspect wheel bearings.										
3. Inspect exhaust systems.										
4. Service and adjust brake systems.										
5. Lubricate universal joints.										
6. Replace windshield wiper blades.										
7. Remove, install, and adjust carburetors.										
8. Perform operational brake inspections.										
9. Lubricate front wheel bearings.										
10. Perform operational engine inspections.										
11. Remove and install starters.										
12. Replace brake shoes.										
13. Replace flasher units.										
14. Install gaskets and seals.										
15. Replace exhaust system components.										
16. Replace fuel pumps.										
17. Remove and install generators or alternators.										
18. Perform operational checks of windshield wiper/systems.										
19. Perform operational inspections of propeller shafts, u-joints, and center bearings.										
20. Remove and install radiators.										
21. Adjust or replace emergency brake controls.										
22. Repair or replace master cylinders.										
23. Remove, install, and adjust distributors.										
24. Repair or replace master or wheel cylinders.										
25. Replace shock absorbers.										
26. Repair or replace switches.										
27. Perform operational inspections on manual transmissions.										
28. Adjust, repair, or replace backup light switches.										
29. Perform operational inspections of electrical systems.										
30. Replace thermostats.										
31. Replace fuel filters.										
32. Inspect seat belts.										
33. Perform inspections of vehicle condition.										
34. Perform operational inspections of fuel systems.										
35. Check or replace exhaust manifolds.										
36. Replace brake hoses and lines.										
37. Perform visual inspections of suspension systems.										
38. Repair or replace windshield wiper units.										
39. Inspect vehicles for compliance with local laws.										
40. Perform operational inspections of positive crank-case ventilation systems.										
41. Repair or replace instruments and sending units.										
42. Install seat belts.										
43. Repair distributors.										
44. Repair or replace relays.										
45. Maintain service station lifts and lubrication equipment.										
46. Replace heater water control units.										
47. Balance wheels and tires.										
48. Maintain tire removal equipment.										
49. Inspect or resurface brake drums.										
50. Initiate and complete work orders.										
51. Service or replace manifold heat controls.										
52. Control flow of work.										
53. Initiate requests for parts.										
54. Repair or replace hydraulic lines and fittings.										
55. Service or replace heater components.										
56. Retrieve disabled vehicles.										
57. Perform operational inspections of exhaust emission control systems.										
58. Install emergency warning devices.										
59. Maintain washrack equipment.										
60. Repair or fabricate hydraulic hoses.										
61. Perform operational automatic transmission inspec-tions.										
62. Review procured parts for installation on proper vehicles.										
63. Repair or maintain power lawn mowers.										
64. Repair locks and latches.										
65. Determine actual cost of vehicle repairs.										
66. Inspect, fabricate, or repair hydraulic lines.										
67. Perform operational inspections of air conditioning systems.										
b. ADVANCED TASKS										
1. Repair or service carburetors.										
2. Analyze causes of vehicle failures.										
3. Repair starters.										
4. Analyze or adjust engine performance using engine analyzer.										
5. Repair generators or alternators.										
6. Repair or replace hydraulic power brake units.										
7. Repair or replace electrical motors.										
8. Repair or replace power steering pumps.										
9. Repair or service air-conditioning systems.										
10. Install air-conditioners in vehicles.										
c. SPECIALTY TASKS										
1. Radiator repair.										
2. Transmission repair.										
3. Front end alignment.										

Figure 9.

TABLE 4.

SAMPLE PROGRESS AND CERTIFICATION REPORTING RECORD

OCCUPATIONAL READINESS RECORD

To The Employer:

This occupational readiness record is both an inventory of the training course content and level of proficiency or achievement demonstrated by the graduate. Graduates can provide potential employers with more complete performance check lists which itemize in great detail the skills and knowledge in which he has demonstrated proficiency. It is recognized that persons working at the specified occupational level will function with direction and assistance from superiors. As a part of his training, the graduate has learned to expect appropriate instructions with each assigned task. Furthermore, the graduate should understand that he lacks the authority and training to perform certain functions and operations. He will expect and seek, supervision, assistance and direction where appropriate. Note that the job tasks as identified, are basic to the next higher or more sophisticated job level. Work experience and further training may qualify the graduate for more complicated tasks, a new job title, and higher pay.

Key To Proficiency Code:

Level L: Limited Skill--does simple parts of task using required tools, but requires instruction and supervision to do most parts of the job. Identifies parts by name, knows simple facts about the job.

Level M: Moderate Skill--requires help on some parts, but can use most tools and special equipment needed. Knows work procedures but may not meet minimum demands for speed or accuracy.

Level S: Skilled--understands operating principles and accomplishes all parts of task with only spot checks of finished work. Meets minimum demands for speed and accuracy.

All graduates receiving this document have satisfactorily demonstrated to the training staff their ability to work safely, understand and carry out instructions, and cooperate with other employees. This document also attests to their punctuality, reliability, and general work habits.

Project ABLE
Quincy Public Schools
American Institutes for Research

JOB FAMILY: Auto Mechanics and Related Occupations
EXIT LEVEL: Service Station Attendant (915.867) and Related Occupations

Name________________ Date________________

Soc. Sec. No.________________ Length of Training________________

Certified by________________ Title________________

Comments________________

L	M	S	
			Shop Safety
			Fire Safety
			Basic Mechanic's Handtools
			Automotive Hardware
			Automotive Terminology
			Identifies Customer Needs
			Cleans Service Area and Equipment
			Raises Cars With Floor Jacks and Combination Bumper-Frame Jacks
			Raises Cars With Twin-Post Hydraulic Lift
			Identifies and Replaces Defective Drive Belts
			Inspects Vehicle Lighting Circuit

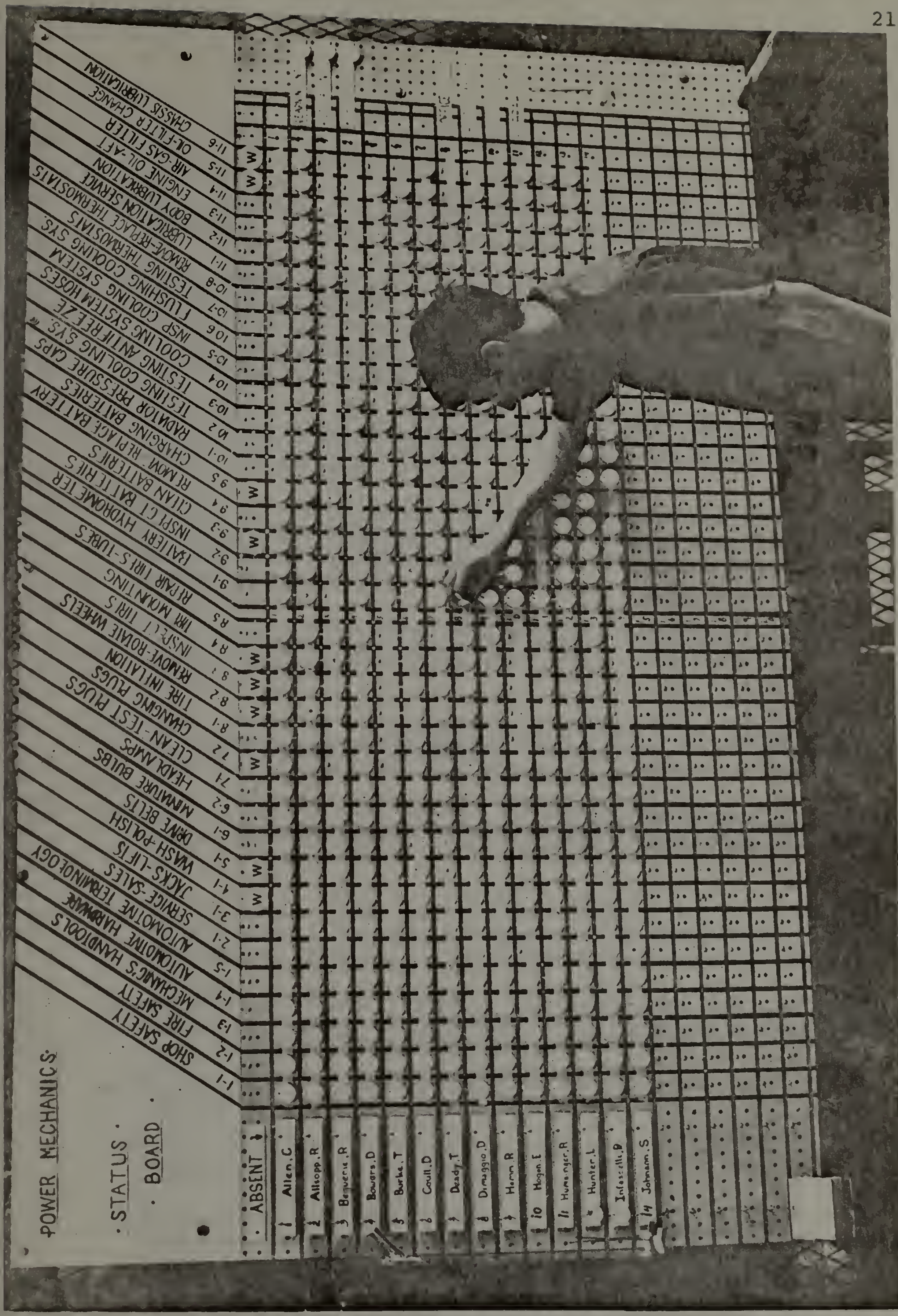
L	M	S	
			Services Miniature Bulbs and Sockets
			Removes and Replaces Headlamps
			Identifies Common Spark Plug Deposits
			Cleans, Gaps and Tests Spark Plugs
			Removes and Replaces Spark Plugs
			Tests and Adjusts Tire Pressure
			Removes and Rotates Wheels
			Inspects Tires and Identifies Common Defects and Wear
			Mounts and Demounts Tubeless and Tube-Type Tires on Tire Machine
			Repairs Tubeless and Tube-Type Tires

L M S	Task	L M S	Task
☐☐☐	Washes and Polishes Vehicles	☐☐☐	Visually Inspects Cooling System Identifies Common Defects and Leak Points
☐☐☐	Tests Battery With Battery Hydrometer	☐☐☐	Flushes and Fills Cooling Systems
☐☐☐	Inspects Batteries and Performs Minor Repairs	☐☐☐	Tests Thermostats
☐☐☐	Cleans Batteries, Posts and Cables	☐☐☐	Removes and Replaces Thermostats
☐☐☐	Removes and Replaces Batteries	☐☐☐	Lubricates Body--Doors, Hinges, etc.
☐☐☐	Charges Batteries With Fast and Slow Charger	☐☐☐	Identifies Specified Engine Oil, ATF and Lube Grease
☐☐☐	Inspects and Tests Radiator Pressure Caps	☐☐☐	Checks Engine Oil and ATF and Fills to Proper Level
☐☐☐	Pressure Tests Cooling Systems	☐☐☐	Determines Oil Lubrication and Filter Service Requirements
☐☐☐	Tests Antifreeze	☐☐☐	Services Air and Gas Filters
☐☐☐	Identifies Common Hose Defects	☐☐☐	Changes Oil and Oil Filter
☐☐☐	Removes and Replaces Hoses	☐☐☐	Lubricates Chassis

The trainee has had limited experience in dispensing fuel, receiving credit and cash payments, and keeping records and inventory. On-the-job training required in these and other areas.

TABLE 5.

STUDENT TRACKING DEVICE


POWER MECHANICS
· STATUS ·
· BOARD ·
ABSENT
1-1 SHOP SAFETY
1-2 FIRE SAFETY
1-3 MECHANIC'S HANDTOOLS
1-4 AUTOMOTIVE HANDTOOLS
1-5 AUTOMOTIVE HARDWARE
2-1 SERVICE-SALES TERMINOLOGY
3-1 JACKS-LIFTS
4-1 WASH-POLISH
5-1 DRIVE BELTS
6-1 MINIATURE BULBS
6-2 HEADLAMPS
7-1 CLEAN-TEST PLUGS
7-2 CHANGING PLUGS
8-1 TIRE INFLATION
8-2 REMOVE-ROTATE WHEELS
8-3 INSP.-C.T. TIRES
8-4 TIRE MOUNTING
8-5 REPAIR TIRES-TUBES
9-1 BATTERY HYDROMETER
9-2 INSP.-C.T. BATTERIES
9-3 CLEAN BATTERIES
9-4 REMOV.-REPLACE BATTERY
9-5 CHARGING BATTERIES
10-1 RADIATOR PRESSURE CAPS
10-2 TESTING COOLING SYS.
10-3 TESTING ANTIFREEZE
10-4 COOLING SYSTEM HOSES
10-5 INSP. COOLING SYSTEM
10-6 FLUSHING COOLING SYSTEM
10-7 TESTING THERMOSTATS
10-8 REMOVE-REPLACE THERMOSTATS
11-1 LUBRICATION SERVICE
11-2 BODY LUBRICATION
11-3 ENGINE LUBRICATION
11-4 AIR-GAS FILTER
11-5 OIL-FILTER CHANGE
11-6 CHASSIS LUBRICATION

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AUTOBIOGRAPHICAL STATEMENT

Joseph S. Nicastro, at the time of the completion of this document, was very much involved in the design and development of a new occupational school and the development of new career occupational programs to serve all of the students of the regional school district. He was Director of the King Philip Regional Vocational High School in Wrentham, Massachusetts. He was responsible for the overall management and supervision of the school, for the assistant director, instructors, counselors, academic personnel, clerical staff, for all curriculum instruction, for scheduling of students, for all expenditures and budgets for vocational-occupational and career education, for the cooperative and work-study programs and for the development of curriculum based on student centered learning systems components.

In addition to being Director of Vocational Education at the King Philip Regional Vocational High School, Mr. Nicastro was a Visiting Lecturer on the Graduate Division Faculty at Fitchburg State College, Fitchburg, Massachusetts, and taught Research Methods in Occupational Education for graduate students working toward their Master's Degree in Occupational Education.

Prior to being appointed Director of the King Philip Regional Vocational High School, Mr. Nicastro was a Research Assistant to the Superintendent of Schools in Quincy, Massachusetts. His duties included support services for grades K to 14. He designed, developed and conducted in-service training programs, workshops and seminars, applied newly developed educational technology, disseminated information and products, developed curriculum, designed proposals for future projects, secured funding and evaluated programs and curricula.

Prior to joining the research staff, Mr. Nicastro served as Project ABLE Coordinator for a joint effort of the Quincy Public Schools and the American Institutes for Research in Pittsburgh. The project was titled The Development and Evaluation of an Experimental Curriculum for the New Quincy (Mass.) Vocational-Technical School. His major assignments for Project ABLE focused on system design analysis, quality assurance and performance and accountability contracting. During the time of the program, he authored a number of technical reports and papers, programmed curriculum material, writing of funded proposals and final reports. He also supervised a staff of some thirty teachers, coordinators, learning psychologists, technical writers, illustrators and clerk-secretaries. He was instrumental in the development of multi-media instructional systems which included job and task analysis, behavioral objectives, programmed materials, instructional devices and simulators, instructional methods and evaluations, modification of laboratories and related research activities. He has served as a consultant to the Great Cities, a consortium of the twenty-one largest school systems in the country, on a curriculum development project for occupational education. Recently, he acted as advisor to a new curriculum development project for occupational education for the six New England States.

Prior to joining Project ABLE, Mr. Nicastro was the first Manpower Director for the Quincy Public Schools under the Manpower Development Training Act Program (MDTA). His duties and responsibilities were to equip the unemployed and underemployed with necessary skills for employment. He served on many local, state and interagency committees. Mr. Nicastro was instrumental in giving technical assistance, advice and recommendations to community groups, agencies and others in the development of training programs to solve local, state and national manpower problems and to stimulate economic development. As the Manpower Director, he designed, developed, secured funding and implemented some sixty projects. He supervised a staff of fifty teachers, three clerk-secretaries, three guidance counselors, six custodians and a student enrollment of 1500 students.

While with the MDTA program, Mr. Nicastro designed, developed and implemented in-service training programs, workshops and seminars. He accepted many assignments to participate in state, local and national conferences, seminars, and workshops. He helped design a state network for all cities and towns in Massachusetts to work with MDTA programs. He helped to design, secure funding and implement the first health programs in Quincy Public Schools (L.P.N.).

Following his trade-high school days, Mr. Nicastro entered the automotive field. His employment background includes twenty-five years of broad administrative and supervisory experiences in industry as owner, co-owner, manager and supervisor of five automotive body repair shops prior to and during his undergraduate and graduate studies.

He gained additional experience while teaching at the Quincy Vocational-Technical School in the Automotive Body Repair and Refinishing trade for twelve years (both related classroom and shop). While teaching days, Mr. Nicastro during evenings and summers, completed his Bachelor and Masters degrees.

After completing extensive courses, Mr. Nicastro served as a visiting lecturer in education at State College at Bridgewater, Massachusetts in the Division of Continuing Studies, where he gave courses to both undergraduate and graduate students in vocational education.

During his career, Mr. Nicastro has been a recipient of a number of awards.